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ARAUJIA ALBENS AS A MOTH-TRAP.

BY ROBERT E. C. STEARNS.[1]

THE plant which I have to notice because of its peculiarity as an insect-trap, rather than on account of its botanical aspect or relations, is referred by botanists to the order Asclepiadaceæ. This order includes the so-called Milk-Weeds, as well as a great number of other curious, interesting, and economically important forms.

The species under consideration—formerly *Physianthus*, now *Araujia albens*—is a native of Buenos Ayres; it has been pretty widely distributed. Its rapid growth, hardy habit, and clean, shining leaves have made it a favorite for ornamental purposes where an attractive, quickly-spreading vine is desired. It has been introduced into this country, to the East and North, in the vicinity of Boston, in Massachusetts, and as far west as the neighborhood of San Francisco, in California. It appears to thrive equally well in these widely remote regions.

In November, 1880, I noticed, one day, three or four moths fluttering in rather a peculiar way upon or around the blossoms of a large *Araujia* vine that covered one side of the porch of my house, in Berkeley, California. I found, upon closer examination, that they were fastened to the flowers, and, upon still more careful scrutiny, that the proboscis was, in each case, submerged in the flower, and the end of it hidden in the interior of the blossom. Besides the living moths, there were several dead ones

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attached to other blossoms. Knowing that many of the plants of the family to which *Araujia* belongs are poisonous, my first thought was that the moths attached to the blossoms, living and dead, were intoxicated or had been poisoned by some peculiar property of the nectar.

Physianthus, or *Araujia*, as a moth-trap had long before been observed and made known, though I was not aware of it. The matter, however, was new to me, and the investigation full of interest, and an ample reward for the trouble. My curiosity was again revived the following year, upon what may be called the recurrence of the late moth season; and further investigations followed it.

My note-book about this time reads: "Saturday, November 5, 1881, detected the first entrapped moths of the (second) season, *nine* in number; some dead, others apparently just caught. Sunday, November 6, eight or nine more; some just alive, others just caught. This morning (Monday, November 7), five more. Tuesday, November 8, a windy and cold day, two. Wednesday, November 9, windy and cold, two;" and so on.

The trapping seasons—for there appear to be *two*—occur in August and November. It may be that there are *two* flights of the principal species of moths that frequent these flowers,—one, the first in early autumn, with apparently a gap; then again, the second and last flight, as indicated, later in the year.

My note-book shows that in the summer of 1883 the first flowers on my *Araujia* vine opened about August 19, and the first trapping of the season—a *bee*—occurred on the following 24th day of said month. August 25, a moth; the 26th, two moths, etc.

The plant continues to bloom for some time after the flights of the moths have ceased, though the number of the flowers gradually decreases with the closing of the autumnal season.

On turning to the figure of the flower it will be noticed that it is trumpet-shaped, flaring at the mouth, where the petals divide, then uniting and forming a tube, which is swollen into a bulbous form where the corolla joins the calyx. Now, this enclosing tube being pulled off, we are able to see the stamens with the side wing-like processes and the exterior spurs pressing against the gymnecium and hiding the ovaries and pollen-masses, as heretofore represented in the figures. The moth, in pursuit of

FIG. 1.

the nectar, first reaches that portion contained in the pockets between the bases of the spurs; then in search of more, having already thrust the proboscis down the tube of the flower, describing a curve between the exterior of the stamineal crown or mass and the inside of the bulb of the perigonium, it then has to push the proboscis upward in order to reach that portion of the flower where the anther-cells, pollen-masses, and glands are in close juxtaposition. Having satisfied its hunger, or otherwise, upon attempting to withdraw the proboscis, as the moth can only make a direct pull, it (the proboscis) not being provided with any muscular arrangement by which the curved motion made in entering, as just described, can be reversed,—to repeat: upon attempting to withdraw its proboscis, *by a direct pull*, it becomes wedged in between the edges of what may be termed the anther-wings, or, rather, the edges thereof, and is held tight, very much in the same way that an old-fashioned boot-jack grips a boot. The more the moth pulls, the tighter or firmer the grip, and escape is impossible, unless the flower has reached such a degree of maturity that its substance has become somewhat softened or wilted.

DESCRIPTION OF FIGURES.

In Fig. 1 we have a spray of *Physianthus*, or *Araujia*, which gives an idea of the general form of the plant, its leaves and flowers.

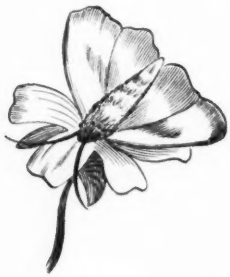


FIG. 2.

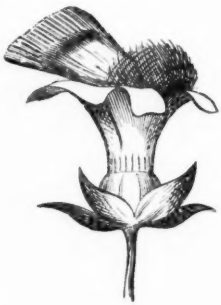


FIG. 3.

In Figs. 2 and 3, a flower, each with a moth upon it, showing a back- and side-view of the insect in repose.

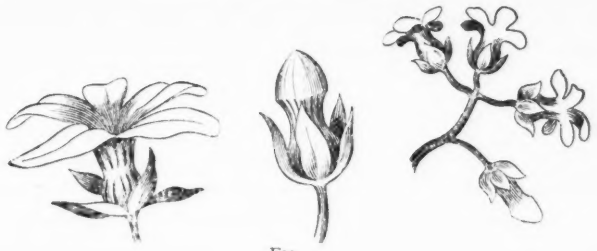


FIG. 4.

In Fig. 4, the perianthum or perigonium, constituting a single flower or blossom.

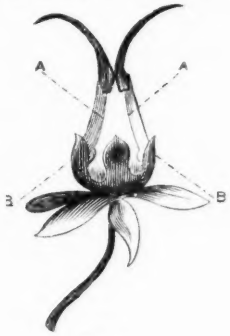


FIG. 5.

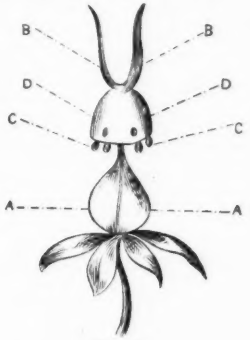


FIG. 6.

In Fig. 5, the stamineal mass or corona-staminea: A, anther-wings; B, exterior spur-like processes to stamen.

Fig. 6, gymnecium, showing ovaries, A; stigma, B; pollen-masses, C; and glands, D.

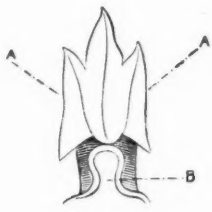


FIG. 7.

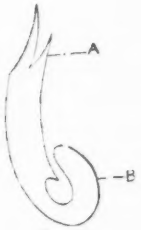


FIG. 8.

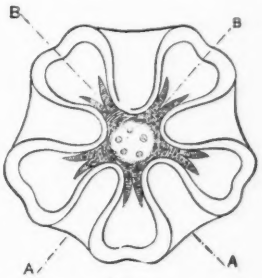


FIG. 9.

Fig. 7, stamen, showing wing-like processes, A, A, and exterior spur, B.

In Fig. 8 a side-view of the stamen figured in 7 is shown. A, A, side-views of wings; B, spur.

Fig. 9, oral view, showing how the spurs A, A, A, A, A head in against the wings B, B, the upper edges of which are seen in pairs, B, B.

The riper flowers, apparently, are not sought by the moths; probably the tempting nectar has lost its sweetness or *bouquet*, or, perhaps, in some way has become changed, or, may be, has been absorbed by the flower in the process of ripening. I have in several instances plucked flowers to which living moths were attached, and have pinned such flowers to the floor of an insect-box, and subsequently found that the moths had freed themselves. The tissues of the flower begin to soften and wilt very soon after separation from the plant. In cases where the moths had freed themselves as above, they seldom lived many hours, and appeared to have died from exhaustion caused by their efforts to escape. As between the moth and the flower, the release or death of the former seems to be reduced to the single point, namely, whether the moth or the flower has the greater vitality.

As some plants are exceedingly sensitive, I thought it possible that the flowers of *Araujia* might be so. I accordingly experimented with a bristle, to learn whether the rigidity of the anther-wings might not be owing to irritability caused by the proboscis of the moth, but was unable to detect any effect of this kind as resulting from friction. By following the same movement or curve that a moth has to follow with its proboscis in reaching up towards the more interior structure of the flower, and then following the further motion that is made by the moth when it tries to withdraw its proboscis, my bristle was held fast between the edges of the wing-like extensions, the same as is the proboscis of a captured moth.

As pertaining to the foregoing remarks, I will mention the following species of Lepidoptera, etc., as determined by various entomological friends, taken by me during three seasons—1880–83—from the blossoms of *Araujia*:

Colias chrysotheme var., *Colias kewaydin*, *Pamphila sylvanus*, *Pyrameis caryæ*, *Pyrameis hunteri*, *Pyrgus syrictus*, *Syrichthus tessellatus*, *Plusia pasiphæia*, *Plusia gamma*, *Agrotis c-nigrum*, *Heliothis* sp.

Other insects are often found upon or within the flowers, such as bees, ants, and beetles, but seldom as prisoners. Among the latter the little (beetle) *Throscus sericeus* Le Conte was detected.

Of the species above named, probably two-thirds of the lepidopterous forms that are caught belong to the three species *Plusia pasiphæia*, *Plusia gamma*, and *Agrotis c-nigrum*.

The list I have submitted contains *eleven* species, as named.

The species of moth which is most frequently trapped on this side of the continent, I have been told, is *Plusia precationis*. It will be noticed that two species of this genus are included in my California list.

As to the simple, ingenious, and effective mechanism exhibited in the structure of the flowers of *Araujia*, whether the same is a device of nature to insure fertilization, through the agency or assistance of the insects it catches, and consequent perpetuation of this plant species, is a question I am unable to answer. Upon the theory of utility, we can hardly conceive of its being without a purpose, or that the peculiar phenomena of plant and insect association in the instance before us are without function, aim, or result, other than the trapping of the insects before mentioned.

BIOLOGICAL INSTRUCTION IN UNIVERSITIES.[1]

BY C. O. WHITMAN.[2]

THE discussion of biological instruction in relation to universities would seem properly to fall to those whose professional standing and experience lend weight to their words; but there are some aspects of the question which lie open to all whose connections with university life have been such as to afford more or less varied opportunities for observation and reflection.

At our last annual meeting Prof. Farlow discussed the question in relation to elementary instruction in colleges and schools. It was made very clear that "*the college instructor must still regard the student who studies under him as a school-boy whose capacity for observing and investigating natural objects has been blunted by a one-sided course of instruction at school.*" The charge is a most grave and startling one; but I think no one would venture to question its entire justice.

We know exactly where the evil lies, but I think the remedy is too generally sought in the wrong direction. It is, in my opinion, a great mistake to suppose that it lies within the power of

[1] Read before the American Society of Naturalists, December 29, 1886.

[2] Director of the Lake Laboratory, Milwaukee.

teachers to abandon methods that lead to such deplorable results. Place in every one of these fitting-schools to-day teachers who know full well the injurious effects of the methods employed, and they would be powerless to abolish the system and replace it by a better. They represent only one of the factors—and that not the most important one—which must co-operate to effect the needed reform. Prof. Farlow suggests that "improvement in the quality of college graduates who could teach biology in schools, if there was any demand for it, gives room for hope." This suggestion brings back at least a part of the responsibility for unsatisfactory methods of teaching to the doors of our colleges and universities. In this direction, more than in any other, lies the remedy for the evils complained of. Our higher institutions of learning represent the creative and directive factor; and to them we must look, first of all, for the supply of competent teachers, and, in the second place, for the creation of that healthy public sentiment which will give support and protection to teachers and school boards in carrying out the desired reforms. The interest of the educated public must be aroused to the supreme importance of cultivating the observing powers of the young before any suitable provision for their training can be expected.

But how shall the capacity for observation be brought into general respect and esteem? Evidently the universities must move first. The stream does not rise higher than its source, and it can hardly be considered a reproach to our preparatory schools if they do not attach great importance to methods of training, the value of which is not made apparent in the requirements for admission to college. It is the fashion to speak of the "cramming system" as the Pandora's box of all the evils we discover in school methods. But where in this country is the college or university which does not foster the system in its rankest form? It is difficult to see why the system is not as good for the schools as for the universities; and it seems pertinent to ask how the latter, while harboring it, can ever expect to eradicate it in the former. But is it, after all, the system itself against which complaints should be directed? We all have to "cram," more or less; and the process is perfectly legitimate and harmless within certain limits. School education begins in cramming, and all through life we go on stuffing the mind with facts, of which

comparatively few can be assimilated and turned to immediate practical account, while others are simply stored up in the crude undigested state. Observation itself is largely a process of cramming; and every investigator knows that science always keeps a large stock of these unassimilated facts on hand. If the observer places a high value on first-hand knowledge, he knows also how to appreciate results obtained by others, and how to make these his stepping-stones.

But let me not be misunderstood. I do not underestimate the difference between feeding and cramming, while insisting that both processes are legitimate. The trouble now is, that we have too much cramming and altogether too little feeding, as a direct result of a one-sided course of instruction. The field of instruction must be broadened so as to include those branches of knowledge which are now generally acknowledged to afford the best means of developing the powers of observation and comparison. The biological sciences hold this position in the estimation of all, or nearly all, who are competent to judge. Elementary training in these branches should begin in the primary schools, as they do in Germany, and be carried on through the grammar and high schools.

This important reform can only be effected through influences emanating from our higher educational institutions. They must make such a reform not only possible, but also necessary. So long as they usurp the functions of the schools, and persist in devoting a large share of their time to that elementary training which ought to begin in the primary and end in the high schools, so long shall we decry in vain the evils of present methods and courses of school instruction. Turn over to the schools the work that belongs to them, then require it of them, and they will find the means to accomplish it readily enough. By all means let biological instruction in universities be pitched on a higher key. Emerson hit the truth very squarely when he said, "Colleges have their indispensable function,—to teach elements. *But they can only highly serve us when they aim not to drill, but to create.*"

Is it presumption to assert that our higher educational system, so far as biology is concerned, aims too low? Then it must be presumption to affirm a truth susceptible of the clearest demonstration. Fortunately, I may assume that such a demonstration is not required here. But if any one doubts the assertion, let him

compare the best organized biological department this country affords with that found in the best German universities. The student who repairs to Berlin, Leipzig, Heidelberg, Würzburg, Freiburg, Munich, and Jena, finds there institutions that aim to make good the title they wear,—institutions that strive to represent every department of knowledge at its best, and to provide room for every form of intellectual activity. Whatever his special bent, he finds in the lecture-courses and the laboratories precisely what he needs. Representing his specialty, he sees men known and revered throughout the scientific world for their contributions to knowledge. He is recognized, not as an irresponsible school-boy, to be marked for absences, ranked for recitations, and rewarded, after a prescribed number of years of study and decent behavior, with a "graduating" degree; but as a man who knows, or ought to know, his purpose, and who, if he ever expects to attain the distinction of a degree, must demonstrate his eligibility thereto by making some worthy contribution to the advancement of knowledge in his own chosen field. Professor and student both work together to the same great end,—the advancement of science. The influences surrounding one arouse every latent energy, and kindle a love and zeal for work that fairly blaze with enthusiasm. The ideal catholicity of aim that everywhere prevails, and the whole-souled consecration of energy to research, create an intellectual atmosphere that is all aglow with inspiration. And what an imposing array of scholarship is here organized for pushing on the work of each department! Does not the enormous productivity of the twenty-one workshops of science represented in the universities of the German empire proclaim with an emphasis that makes argument superfluous, the importance of high aims in the organization of each and every department of instruction? In Germany, as here and everywhere, the character of the preparatory schools is determined by that of the academic system. But university influence does not stop with the enforcement of eight or nine years of rigid discipline in the gymnasium; it pervades the entire school-system, and is thus in a very large measure directly responsible for the methods and courses of instruction pursued.

The simple secret of this dominating influence is *devotion to research* as the prime means and the chief end of higher education. It is this same crowning feature which creates and keeps

alive popular respect for the investigator and his methods, and which makes biological training not only a possible but also a recognized essential of school-work.

With such an example before us, it ought to be unnecessary to urge the practical lesson it teaches. But we are under the spell of our "historical roots," and there seems to be a too general conviction, or conceit, that we are doing fairly well under the circumstances. In some quarters, allusion to the superiority of the German system is enough to raise a storm of indignation against the "grumbler." And yet we go on year after year sending students abroad to complete their biological education; and in nine cases out of ten they turn their backs on the land of "historical roots" and repair to Germany. The proverbial thoroughness of the Germans, their mastery of methods, the wealth of their literature, and the liberality with which they provide for instruction and assistance in every branch of knowledge, appeal to the strongest instincts and needs of every student who, having resolved to devote his life to the unremunerative service of science, and having availed himself of the best that home instruction affords, still finds himself too poorly equipped for special work.

I am well aware that within the last five or ten years there has been some improvement in this country, both in the methods and the aims of biological instruction. I have in mind especially zoological instruction, but have good reason to believe that the same is true of the botanical side. But unless my observation is greatly at fault, we are almost wholly indebted to German sources for these improvements. A few of our best colleges and universities—unfortunately not all—have in the service of the biological departments men trained in European laboratories, who, in spite of the exorbitant demands made upon their time and energy for elementary courses, undertake to provide for instruction in modern methods of research, and to introduce students into special lines of work. It is certainly one of the hopeful signs, that the incredulity which such methods and courses first encountered is fast lapsing into passive resignation. But I think it is to be regretted that such praiseworthy aims should meet with mere indifferent toleration instead of hearty co-operation and encouragement,—and this too in the very places where their high value ought to receive its first recognition.

It is certainly time that the higher side of biological instruction should receive more attention, and it is unquestionably one of the first duties of an institution, which strives to be a university in reality as well as in name, to see to it that the productive side of the department is encouraged and maintained at a level of high respectability. Scientific activity flourishes only when research is made the dominant aim, and when, for the realization of the aim, the working forces are organized with a view to representing every important side of the department, and on a basis which provides for giving the larger share of energy to productive investigation. For the efficiency of the department, then, we have this double test,—*high aims* and *comprehensive organization*.

What constitutes a properly organized corps of instructors, and what should be the paramount aim in any given department of science, are questions for the specialists in that department. It is the position, the scope, and the tendencies of the sciences represented which claim foremost consideration in such questions. The value of any plan of organization will depend, not upon whether it will provide for the more general needs ascertained by experience, but upon its capacity for expansion and its ability to supply needs not already clamored for. Any organization trimmed to provide merely what the uninstructed public ask for can never fulfil its highest function, which is to *create* and *direct*, not to adapt and conform. An educational institution which limits itself to elementary instruction may advertise itself as a university; but where is the educated public that does not see through the mask of such ill-founded pretensions?

It has been said that in German universities too exclusive regard is paid to the promotion of scientific and literary activity. I wish that academic administration in this country could be justly charged with such a fault. But our boasted "practical" wisdom has never been known to err in the same laudable direction. We hear altogether too much about the necessity of providing for the general purposes of education; but seldom any allusion to the fact, which appears so eminently practical to some of us, that a liberal provision for the higher ends of education is the only means by which those general purposes can be successfully reached. Let a department be organized with a view to the fulfilment of its higher functions, and you place it on the only basis that admits of the healthy exercise of its non-productive

functions. Take care of the creative functions, and the vegetative functions will take care of themselves. The precept is as pertinent to the life of a university as to that of an individual.

The question then reduces itself to this,—How can a biological department be most efficiently and comprehensively organized for the fulfilment of its higher purposes? Every special question which the subject presents finds its solution in the same direction. Take, for example, the preparation of students for teaching biology. It is plainly not a question of turning the biological department into a sort of factory for the manufacture of teachers of the stamp which may just now have the highest market value. The question is not how to fit, but how to equip,—not how young men can be fitted to teach natural history as it happens to be taught now, but how they can be most thoroughly prepared for improving and renovating existing methods and systems. The best teachers have always been investigators; hence the aim should be, on the part of one who proposes to follow teaching as a profession, to become an investigator, and, on the part of university instructors, to make as many investigators as possible. This may be an ideal plan, which, in the majority of cases, cannot be fully carried out on either side; but this, to my mind, so far from being an objection, is its best recommendation. All that I claim is, that the most satisfactory results are to be obtained by working in this direction. A plan is not necessarily impractical because its fullest realization is impossible; and in the organization of any department of instruction in a university, the highest results are never attained where anything less than ideal aims are tolerated.

A practical question of great importance here presents itself: What should be the attitude towards, and what the advice to, students who have a strong predilection for biological research, but who will be dependent for their support on the salaries which they may earn? I believe the policy of discouraging such a purpose has been carried to a dangerous extreme in this country. Those who know by personal experience what it costs to venture in this direction need no apology for the impatience which is aroused, when they see the real difficulties increased by the incubus of discouraging advice and an indifferent, unsympathetic, chilling attitude. Such advice may do little harm to one who has the self-reliance to "plant indomitably on his instincts, and

there abide till the huge world comes round to him," and the courage to defy every obstacle which timid counsels can conjure up; but it works like a damper on the aspirations of many a less resolute mind, and has unquestionably done much to retard the progress of biological work in this country. When those who speak for our leading universities tell us that these institutions are the best places for the prosecution of research, and that we must look to them for most of the work in pure science, we would fain believe it; but when, in the next breath, they proceed to give us solemn warning that we are under the curse of Adam, and that "*the first business of every man is to win his bread*," we begin to suspect that, if the intentions are all right, the policy may be all wrong. When, still further, we are advised that our first concern should be to bring "*to the educational exchange qualities which are always in demand, and which always receive remuneration*," we begin to see that, if such councils are to prevail, the days of "our long apprenticeship to the learning of other lands" are not yet numbered. How utterly unworthy appears such advice by the side of Emerson's inspiring exhortations to self-reliance! Some men never bow to Adam's curse, nor rebel against it; but, busy with higher purposes, ignore it. Such a man was Louis Agassiz. One such example, one such counsellor, puts to shame a world of those who place policy above the noblest aims of life. You might as well command the waters of Niagara to turn back as attempt to still the intellectual hunger of such men by pointing out the difficulties and disappointments which they are likely to encounter if they obey their instincts.

I am certain that every man who places the pursuit of pure science above public applause and the allurements of wealth, in a word, above every mercenary consideration, must be filled with surprise and regret at the avowal of such sentiments by those who are shaping the destinies of our higher educational establishments. Is that what is needed in a country that can boast of nothing higher than the performances of mechanical skill, where there is little market for anything above a bread-and-butter mediocrity, and where there is so little appreciation for any science which cannot be converted into immediate wealth? Just imagine what a dreadful misfortune it would be for this country "if we should find in the course of a few years a superabundance of men with rare acquisitions of a kind for which there is no de-

mand!" Is it possible that any one who realizes the destitution of this country in respect of men devoted to science, and who is aware of the fact that the number must be increased a hundredfold before a position of fair respectability can be reached, can take alarm at the disposition sometimes shown by graduate students to engage in special lines of research? Whoever fears the tendency of modern science to specialization must have failed to catch the full significance of this tendency. Such counsellors have fallen into the same error against which they warn others. For, instead of looking at the subject broadly and in the light of history, they fix their eyes on some real or imaginary excesses. They find a few narrow-minded men engaged in very special lines of investigation,—men who know their specialty well, but little else,—and they infer that narrowness and specialization necessarily go together. The term specialization has thus been degraded, and specialists find themselves heirs to an opprobrium for which the only foundation is a vulgar misconception. Every specialist who stands on the approval of his own conscience is well able to bear his cross; but he cannot look with indifference on the tendency to superficiality which such a misconception directly encourages. I have in mind more than one aspirant for scientific fame who, from sheer fear of being too special, has fallen a victim to the curse of superficiality. Certainly missionary work is not very far from our doors, and if I am the least qualified of all to undertake such work, I trust I shall not transgress the bounds of propriety in urging others to do it. When we remember that specialization has marked every step in the progress of science, and that every advance in the future must inevitably carry us still farther in the same direction, we can hardly wonder that those who, as spectators, see the grand army of workers splitting up into more and more numerous divisions, as the necessity for more special work arises, should regard the whole movement as one tending to weakness and narrowness. But those who march in the ranks can have no excuse for such a groundless fear. They at least ought to know that there is just as little reason for making specialization a synonyme for narrowness as for connecting generalization with shallowness. None can know better than they that specialization is the only proper basis for generalization, and that the two are indissolubly related as means to end. But there are hangers-on who wear

the uniform and are ambitious to grab the honors without sharing the work. They are a most dangerous foe, for their pretensions are a source of deception to honest people. These are the men who, under the delusion that shallowness is breadth, flit from point to point, snatching a little here and a little there, learning a little of everything and not much of anything, aiming to amaze the vulgar with glib talk and profuse writing, while they disgust every conscientious worker. To such the hard toil of special work is irksome drudgery, proper enough for minds of small calibre, but quite foreign to the philosophical province to which they aspire. You would never recognize these impostors by the names they desecrate; for some of them call themselves zoologists, and insist that staring at the outside of things is the only proper method of teaching or investigating; and a few, seeing that biologist is a word of many meanings, and therefore just adapted to their versatile character, flourish that title. The distinctive mark of the whole genus, as you will always learn on close acquaintance, is a single eye set in the hindhead instead of the forehead. They know nothing of the tendencies of the biological sciences, and are therefore as incapable of steering their own craft as of directing others. The backward vision incapacitates them from ever understanding either the needs of the future or the lesson of the past. They would organize a biological department on a basis suited to the times of Linnæus; because, forsooth, Linnæus was a great man, whose mind could compass a "Systema Naturæ" which embodied all that was then known of the distinctive characters of minerals, plants, and animals. This was natural history in the broadest acceptation of the phrase, and it is only the breadth, as pure surface expansion, that these men look at. They cannot, or will not, see that our intellectual horizon has been extended in proportion as science has made it necessary to sacrifice superficial breadth to profundity.

The misfortune is that these opinions are so generally accepted, as the state of biological instruction in the four hundred or more institutions of the country calling themselves colleges and universities abundantly shows. Argument will never dislodge them; they can be reached only through the leavening influence of high examples. A single biological department organized on a basis broad enough to represent every important branch at its best, and provided with the means necessary to the freest exercise of its

higher functions, would furnish just the example we stand in need of. It is clear enough where we ought to look for such examples, but it is not so clear where or when we shall find them. We have often heard of the "coming university," but still it comes not. Men and money are all that is required to create such a department, and the country has both. We wait only for the rare conjunction of wisdom, will, and means for the realization of the long-postponed expectation.

Having considered the general aims and principles which should determine the organization of a biological department, some of the more dangerous prejudices in the way of improvement, and the source and direction of reform, it remains to notice more precisely the ground to be covered by such a department. As before remarked, the nearest approach to an ideal organization is to be found in German universities. The biological sciences are distributed among five separate institutes, called, respectively, the botanical, the zoological, the physiological, the anatomical, and the pathological. Each institute consists of a spacious edifice, containing special and general laboratories provided with instruments and other necessaries for instruction and investigation, lecture-rooms, library, and museum. The zoological institute has, besides, its aquaria, terraria, and garden; and the botanical institute has, of course, its experimental garden. At the head of the official staff of each institute is the professor, with two or more able assistants, and other subordinates trained to aid in laboratory work. But this is not all, for we often find as many as three or four, and sometimes as many as five or six, professors, ranking as *ordinary*, *ordinary and honorary*, and *extraordinary*, all engaged in the work of a single institute. It is a common thing to find the lecture-work in any given subject divided among three or four eminent investigators, in such a manner that each special side of the subject has its special course of lectures extending through one or more entire semesters. This is the case, for example, with histology and embryology, subjects which are often pointed out in this country as the dangerous extremes of specialization. This division of labor has thus been carried much farther than a superficial glance would lead one to suppose. And has this principle been carried too far? and are there now signs of a reaction? Absolutely nothing of the kind. On the contrary, the marvellous rapidity with which the biological sci-

ences are developing carries it still farther every day. And as the process goes on instruction becomes more thorough and, at the same time, more comprehensive, while investigation marches on with increased speed from one achievement to another. Specialization is a terror only to those who do not understand it. A German specialist devotes ten or fifteen years to the study of the development of the chick or the frog, and a German university provides courses of lectures on just such special subjects as these. Does that appear narrow? Those who imagine that such profound special study means intellectual narrowness could profitably spend five years in the study and contemplation of the facts presented in one of those embryological monographs. In the course of such an experience they might discover that the embryologist's conception of a chick is a little too broad for their idea of a barn-yard fowl. By the time they had followed this unpretentious creature through the animal kingdom, studied the comparative lessons of its anatomy, histology, embryology, and physiology, they would begin to comprehend what a fearfully general thing specialization really is. It might occur to them that more thorough methods of research have made it necessary to limit the field of original work while broadening immensely the field of vision.

The natural history of the last century, as I have said, included mineralogy as well as botany and zoology. In course of time mineralogy dropped out, while zoology and botany were drawn into the closer relation denoted by biology. The word biology was proposed as long ago as 1802, simultaneously, but independently, in France and Germany, by Lamarck and Treviranus. Since that time both divisions of biology have grown to something more than single sciences. Each represents now a great department of knowledge, embracing half a dozen or more distinct sciences. Zoology—leaving aside botany—is subdivided into anatomy, histology, embryology, phylogeny, taxonomy, and physiology. Cytology is a new offshoot, developed from embryology and histology, and forming a common basis for the botanical and zoological sciences.

A lengthy paper might profitably be devoted to the consideration of the scope of these several sciences, with a view to showing how extensive ought to be the provision for instruction and investigation in each. It is not my intention, however, to pursue

the subject further here. It suffices for the present to say that no one of them can be adequately represented by less than two instructors; and some of them require, at least, as many as four or five.

It must be evident to all that no approximation to such a standard of organization is anywhere to be found in this country. It is a common error to suppose that zoological instruction is liberally provided for by one professor and one assistant. You will find that this idea, or a worse one, still regulates the policy of our leading colleges and universities. The result is that we find the professor trying to make a single course of lectures cover anatomy, histology, embryology, cytology, physiology, distribution, evolution, and in fact everything that can be legitimately squeezed in. Allowing that there are circumstances which make it appear advisable to spread so exceedingly thin,—and that is fully enough to concede,—is it not perfectly evident that, where this is the best that can be offered, no claim can be justly made to providing for the higher needs of lecture-courses? But what shall be said of those institutions which aim to take foremost rank among our universities, and yet regard zoology as too narrow a field for one man, requiring the professor to shoulder the burden of directing the instruction in zoology and botany, and in some cases physiology too? And ought we to let it go unmentioned that some colleges and universities of high respectability still abide in the typical Linnæan stage of development, leaving one man to grapple with the whole system of nature? Still greater marvels of persistent ancestral types might be placed before you, but certainly they would not improve the picture.

Our need is a few creditable examples, and to those who know what such examples call for we must look for their ultimate attainment.

HISTORY OF GARDEN VEGETABLES.

BY E. LEWIS STURTEVANT, A.M., M.D.[1]

(Continued from page 444.)

CABBAGE. *Brassica oleracea capitata* L.

THE headed cabbage, in its perfection of growth and its multitude of varieties, bears every evidence of being of ancient origin. It does not appear, however, to have been known to Dioscorides, or to Theophrastus, of the Greeks, nor to Cato, among the Romans; but a few centuries later their presence is indicated by Columella[2] and Pliny,[3] who, in his "Tritianon" kind, speaks of the head being sometimes a foot in diameter, and going to seed the latest of all the sorts known to him. The descriptions are, however, obscure, and we may well believe that if the hard-headed varieties now known had been seen in Rome at this time they would have received mention. Olivier de Serres, quoted by A. Soyer,[4] says, "White cabbages came from the north, and the art of making them head was unknown in the time of Charlemagne." Albertus Magnus,[5] who lived in the thirteenth century, seems to refer to a headed cabbage in his "Caputium," but there is no description. The first unmistakable reference to a cabbage that I find is by Ruellius,[6] in 1536, who calls them *capucos coles* or *cabutos*, describes the head as globular and often very large, even a foot and a half in diameter. Yet the word *cabaches* and *caboches* used in England in the fourteenth century indicates the cabbage as then known and distinguished from *coles*.[7] Ruellius also describes a loose-headed form called *Romanos*, and this name and description, when we consider the difficulty of heading cabbages in a warm climate, would lead us to believe that the Roman varieties were not our present solid-heading type, but loose-headed, and perhaps of the Savoy class.

Our present cabbages are divided by De Candolle[8] into five types or races,—viz., the flat-headed, the round-headed, the egg-

[1] Director of the New York Agricultural Experiment Station, Geneva.
[2] Columella, lib. x. l. 138.
[3] Pliny, lib. xix. c. 41.
[4] Soyer, Pantropheon, 61.
[5] Albertus Magnus, De Veg., lib. vii. c. 90.
[6] Ruellius, De Natura Stirpium, 1536, 477.
[7] The Forme of Cury, 1390, Warner's Antiq. Culin., 1791.
[8] A. P. De Candolle, Memoir, Lond. Hort. Soc. Trans., 1821.

shaped, the elliptic, and the conical. Within each class are many sub-varieties. In Vilmorin's standard work, "Les Plantes Potagères," 1883, fifty-seven kinds are described, and others mentioned by name. In the "Report of the New York Agricultural Experiment Station" for 1886, seventy varieties are described, excluding synonymes. In both cases the Savoys are treated as a separate class, and are not included. The history of these forms, as well as I can make out, will now be given.

The Flat-Headed Cabbage.—The type, the "Quintal." The first appearance of this form that I find is in "Pancovius Herbarium," 1673, No. 612. A "common flat-winter," probably this form, is mentioned by Wheeler,[1] 1763; the "flat-topped" is described by Mawe[2] in 1778. The varieties that are now esteemed are remarkably flat and solid.

The Round Cabbage.—The type, the "Early Dutch Drumhead." This appears to be the earliest form with which we are acquainted, as it is the only kind figured in our early botanies, and was hence presumably the only, or, perhaps, but the principal, sort known during several centuries. The following synonomy is taken from drawings only, and hence there can be no mistake in regard to the type:

Brassicæ quartum genus. Fuch., 1542, 416.
Kappiskraut. Roszlin, 1550, 87.
Caulis capitulatus. Tragus, 1552, 717.
Brassica capitata. Matth., 1558, 247; Pinæus, 1561, 163; Cam. Epit., 1586, 250.
Kol oder Kabiskraut. Pictorius, 1581, 90.
Brassica alba sessilis glomerata, aut capitata Lactucæ habitu. Lobel ic., 1591, i. 243.
Brassica capitata albida. Lugd., 1587, i. 521; Dod. Pempt., 1616, 623.
Brassica capuccia. Cast. Dur., 1617, 78.
Brassica capitata alba. Bodæus, 1644, 777; J. Bauhin, 1651, ii. 826; Chabræus, 1677, 269.

The descriptive synonymy includes the "losed" cabbage, a great round cabbage of Lyte's "Dodoens," 1586; the White cabbage cole of Gerarde, 1597; the White Cabbage of Ray, 1686; the chou pomme blanc of Tournefort, 1719; the English of Townsend, 1726; the Common white of Wheeler, 1763; the

[1] Wheeler, Bot. and Gard. Dict., 1763, 79. [2] Mawe, Gard., 1778.

English, or late, of Stevenson, 1765; the Common round white of Mawe, 1778, etc.

The Egg-Shaped.—The type of the "Sugar-Loaf." Vilmorin[1] remarks of this variety, the Sugar-Loaf, that, although a very old variety, and well known in every country in Europe, it does not appear to be extensively grown anywhere. It is called *chou chicon* in France,[1] and *bundee kobee* in India.[2] It is mentioned by name by Townsend,[3] in 1726; by Wheeler,[4] in 1763; by Stevenson,[5] in 1765; by Mawe,[6] in 1778, etc. Perhaps the large-sided cabbage of Worlidge[7] and the long-sided cabbage of Quintyne[8] belong to this division.

The Elliptic Cabbage.—The type is the "Early York." This is first mentioned, so far as I can ascertain, by Stevenson[5] in 1765, and he refers to it as if a well-known sort. According to Burr, it came originally from Flanders. There are now many varieties of this class.

The Conical Cabbage.—The type is the "Filderkraut." This race is described by Lamarck[9] in 1783, and, if there is any constancy between the name and the variety during long periods, is found in the *Battersea*, named by Townsend[10] in 1726, and a whole line of succeeding writers.

It is certainly very singular that but one of these races of cabbage received the notice of the older botanists (excepting the one flat-topped given by Chabræus in 1677), as their characteristics are extremely well marked, and form extreme contrasts between the conical or pointed and the spherical headed. We must, hence, believe that they either originated or came into use within a recent period. How they came, and whence they came, must be decided from a special study, in which the effect of hybridization may become a special feature. From the study of sports that occasionally appear in the cabbage-garden, the suggestion may be offered that at least some of these races have been derived from crossings with some form of the Chinese cab-

[1] Vilmorin, The Veg. Gard., 1885, 110.
[2] Speede, Ind. Handb. of Gard., 1842, 112.
[3] Townsend, Seedsman, 1726, 26.
[4] Wheeler, Bot. and Gard. Dict., 1765, 79.
[5] Stevenson, Gard. Kal., 1765, 119, 26.
[6] Mawe, Gard., 1778.
[7] J. W., Gent. Syst.-Hort., 1683, 202.
[8] Quintyne, Comp. Gard., 1693, 189.
[9] Don, Gard. Dict., 1831, i. 223.
[10] Townsend, Seedsman.

bage, whereby form has become transferred while the characteristics of the Chinese species have disappeared. On the other hand, the Savoy class, believed to have origin from the same source as the cabbage, have oval or oblong heads, which have been noted by the herbalists.

The Cabbage is called, in France, *Choux cabus, chou capu, chou en tête, chou pomme, chou pomme à feuille lisse;* in Germany, *Kopfkohl, Kraut;* in Flanders, *kabuiscool;* in Holland, *slutkool;* in Denmark, *hoved kaal;* in Italy, *cavolo cappuccio;* in Spain, *col repollo;* in Portugal, *couve repolho;*[1] in Sweden, *huvudkal.*[2]

The ancient names were, in France, *capucos coles*, or *cabutos*, Ruel., 1536; *chou cabus*, Lyte, 1586; in Germany, *Kappiskraut*, Adv., 1570; *Kapskraut*, Pin., 1561; in Italy, *cavolo cappuccio* and *cappuzzino*, Pin., 1561; in Spain, *repolho* and *colhes morcianos*, Pin., 1561.

Caper. *Capparis spinosa* L.

The caper, although rarely grown in this country, forms an object of extensive culture in the Mediterranean region for the sake of the flower-buds, which enter into commerce for use as a pickle or appetizer. The Greeks of the Crimea eat the shoots as well as the buds,[3] and in Egypt the fruit, which in this variety is very large, is eaten by the Arabs.[4] In Sindh and the Panjab, India, the fruit is also pickled and eaten.[5] According to Ruellius,[6] Aristoteles and Theophrastus describe the plant as not cultivated in gardens; but in his time (1536) it was in the gardens of France. Unger[7] says it was known to the ancient Greeks, and the renowned Phryne, at the first period of her residence in Athens, was a dealer in capers. The plant has become widely distributed, and was introduced into South Carolina about 1755.[8]

There are two forms now known,—the spined and the unarmed. The former is the most esteemed, although *C. inermis* is also grown in France. Both kinds have been known for a long time, as the following partial synonymy indicates:

[1] Vilmorin, Les Pl. Pot., 1883, 103.
[2] Tengborg, Hort. Culin., 1764, 23.
[3] Pallas, Trav., iv. 224.
[4] Wilkinson, Ancient Egyptians, ii. 29.
[5] Brandis, Forest Flora, 14.
[6] Ruellius, De Nat. Stirp., 1536, 561.
[7] Unger, Plants used as Food by Man, U. S. Pat. of Rept., 1859.
[8] Hist. of the Mass. Hort. Soc., 29.

I.

Capparia. Ruellius, 1536, 561.
C. spinosa, fructu minore, folio rotundo. Bauh., Pin., 1623, 480.
C. spinosa. J. Bauh., 1651, ii. 63.
C. spinosa. Linn., Sp., 720.
Caprier. Vil., 1883, 55.
Capers.

II.

Capparis non spinosa fructu majore. Bauhin, Pin., 1623, 480.
C. non spinosa. J. Bauhin, 1651, ii. 63; Tourn., Inst., 1719, 261.
C. inerme. Naud. & Decaisne, Man., iv.
Caprier, variete sans epines. Vilm., 1883, 55.

The Caper-tree is called, in France, *caprier;* in Germany, *Kapernstrauch;* in Flanders and Holland, *kapperboom;* in Italy, *cappero;* in Spain, *alcaparra;* in Portugal, *alcaparreira.*[1]

In Arabic, *kabar*, or *kabbar;*[2] in Afghan, *kabaria;* in Thibet, *kabra;* in Panjab, *kaur, kiari, kakri, kandee, taker, ber, barari, bauri, bassar;* in Sindh, *kalvari.*[3]

CARAWAY. *Carum carui* L.

The seeds of caraway were found by O. Heer[4] in the *débris* of the lake habitations of Switzerland, which establishes the antiquity in Europe. This fact renders it more probable that the Careum of Pliny[5] is this plant, as also its use by Apicius[6] would indicate. It is mentioned as cultivated in Morocco by Edrisi in the twelfth century; and in the Arab writings, quoted by Ibn Baytar, a Mauro-Spaniard of the thirteenth century, it is likewise named; and Fluckiger and Hanbury think the use of this spice commenced at about this period. It is not noticed by St. Isidore, Archbishop of Seville in the seventh century, although he notices dill, coriander, anise, and parsley; nor is it named by St. Hildegard in Germany in the twelfth century. But, on the other hand, two German medicine-books of the twelfth and thirteenth centuries use the word *cumich*, which is still the popular name in Southern Germany. In the same period the seeds appear to have been used by the Welsh physicians

[1] Vilmorin, Les Pl. Pot., 1883, 55.
[2] Delile, Fl. Ægypt, illust.
[3] Brandis, Forest Flora, 14.
[4] O. Heer, Gard. Chron., 1866, 1068.
[5] Pliny, lib. xix. c. 49.
[6] Apicius, lib. i. c. 30; ii. c. 4; viii. c. 2.

of Myddvai, and caraway was certainly in use in England at the close of the fourteenth century,[1] and is named in Turner's "Libellus," 1538, as also in "The Forme of Cury," 1390.

Caraway appears as a wild plant in Iceland, Scandinavia, Finland, Arctic, Central, and Southern Russia, Persia, and in Siberia; also Eastern France, Spain, Central Europe, America, and the Caucasus, as well as in the Western Himalayas. It is largely cultivated in a distinct variety in Morocco. In commerce the seed is received from Finmark, Finland, and Russia, Prussia, Holland, and Morocco.

This plant is cultivated in gardens for its under leaves, which are used for flavoring soups and salads, and for its seeds, which are often mixed with bread, or in making "seed-cakes," and in Germany are put into certain cheeses. The root is tender, and is better than a parsnip, as was observed by Parkinson and Ray; and Vilmorin, in 1883, says it can be so used, but this use now is probably very infrequent.

Caraway is called, in France, *carvi, anis des Vosges, cumin des pres;* in Germany, *Kummel;* in Holland, *karvii;* in Denmark, *kommen;* in Italy, *carvi;* in Spain, *carvi, alcaravea;* in Portugal, *alcaravia;*[2] in Arabic, *karaoweh,*[3] or *curweeya.*[4]

Cardoon. *Cynara cardunculus* L.

The cardoon is indigenous in the Mediterranean region, but has become naturalized elsewhere, as in Banda Oriental, where several hundred square miles have become covered by one mass of these prickly plants, and are impenetrable by man or beast.[5] The cultivated plant is little grown in England or in America, but in France, Italy, and generally in Europe the stalks and inner leaves, rendered white and tender by blanching, are in esteem. To the ancient Romans it was well known and cultivated for the footstalks, as at present.[6] Pliny[7] complains of the great price that monstrous-grown specimens brought at Rome, and that especially fine varieties came from Carthago and Corduba, in Spain. In more recent times, Ruellius,[8] in 1536, speaks of the use of the herb as a food, after the manner of

[1] Pharmacographia, 1879, 304.
[2] Vilmorin, Les Pl. Pot., 72.
[3] Delile, Fl. Ægypt, illust.
[4] Birdwood, Veg. Prod. of Bombay, 39, 237.
[5] Darwin, Voy. of a Nat., i. 153.
[6] Targioni-Tozzetti, Hort. Trans., 1854, 142.
[7] Pliny, lib. xix. c. 43.
[8] Ruellius, De Nat. Stirp., 1536, 643.

asparagus. Matthiolus,[1] in 1558, says there are many varieties in the gardens which are commonly called *Cardoni* by the Hetruscans, and that, diligently cultivated, these are tender, crisp, and white, and are eaten with salt and pepper. In 1623 Bauhin[2] calls the plant *Cinara spinosa, cujus pediculi esitantur.*

Vilmorin[3] describes five varieties,—the *Cardon de Tours*, the *Cardon plein inerme*, the *Cardon d'Espagne*, the *Cardon Puvis*, and the *Cardon à cotes rouges.*

The first of these, the *Cardon de Tours*, is very spiny, and we may reasonably believe it to be the sort figured by Matthiolus[4] in 1598, under the name of *Carduus aculeatus.* It is named in French works on gardening in 1824, 1826, 1829, etc.[5] Its English name is *Prickly Solid Cardoon;* in Spain it is called *Cardo espinoso.* It holds the first estimation with the market-gardeners of Tours and Paris.

The *Cardon plein inerme* is scarcely spiny, is a little larger than the preceding, but otherwise closely resembling. J. Bauhin[6] had never seen spineless cardoons. It is spoken of in 1824, in French books on gardening. It is called, in English, *Smooth-Solid Cardoon*, and has also names in Germany, Italy, and Spain.

The *Cardon d'Espagne* is very large and not spiny, and is principally grown in the southern portions of Europe. We may reasonably speculate that this is the sort named by Pliny as coming from Corduba. "Cardons d'Espagne" have their cultivation described in "Le Jardinier Solitaire," 1612. A "Spanish cardoon" is described by Townsend[7] in England in 1726, and the same name is used by McMahon[8] in America in 1806. It is the *Cynara integrifolia* of Vahl.

The *Cardon Puvis*, or *Artichoke-leaved*, is spineless, and is grown largely in the vicinity of Lyons, France. It finds mention in the French books on gardening of 1824, 1829, etc., as previously enumerated.

The *Cardon à cotes rouges*, or *Red-stemmed*, is so named from having the ribs tinged with red. It is called a recent sort by Burr in 1863.

[1] Matthiolus, Com., 1558, 322.
[2] Bauhin, Pin., 1623, 383.
[3] Vilmorin, Les Pl. Pot., 1883, 59.
[4] Matthiolus, Op., 1598, 496.
[5] L'Hort. Fran., 1824; Petit, Dict. du Jard., 1826; Noisette, Man., 1829.
[6] J. Bauhin, Hist., 1651, 50.
[7] Townsend, Seedsman, 1726, 29.
[8] McMahon, Am. Gard. Kal., 1806.

From a botanical point of view we have two types in these plants,—the armed and the unarmed; but these characters are by no means to be considered as very constant, as in the Smooth-Solid we have an intermediate form. In an olericultural point of view we have but one type throughout, but a greater or less perfection. A greater acquaintance with the wild forms would, doubtless, show to us the prototypes of the variety differences as existing in nature.

The cardoon is called, in France, *cardon*, *cardonette*, *chardonnerette*, *chardonnette;* in Germany, *Cardy*, *Carde;* in Flanders, *kardoen*, *cardonzen;* in Denmark, *kardon;* in Italy, Spain, and Portugal, *cardo*.

Carrot. *Daucus carota* L.

The carrot and the parsnip, if known to them, seem to have been confounded in the descriptions by the ancients, and we find little evidence that the cultivated carrot was known to the Greek writers, to whom the wild carrot was certainly known.[1] The ancient writers usually gave prominence to the medical efficacy of herbs; and if our supposition be correct that their carrots were of the wild form, we have evidence of the existence of the yellow and red roots in nature, the prototypes of these colors now found in our cultivated varieties. Pliny,[2] who was a naturalist, says they cultivate a plant in Syria like *staphylinos*, the wild (?) carrot, which some call *gingidium*, yet more slender and more bitter, and of the same properties, which is eaten cooked or raw, and is of great service as a stomachic; also a fourth kind, resembling a pastinaca somewhat, called by us *Gallicam*, but by the Greeks *daucon*. This comparison with a parsnip and the name is suggestive of the cultivated carrot. Galen, a Greek physician of the second century, implies cultivation of the carrot when he says the root of the wild carrot is less fit to be eaten than that of the domestic.[3] In the thirteenth century, however, Albertus Magnus (lib. vii. tract. ii. cap. 1–4) treats of the plants under field culture, garden culture, orchard culture, and vineyard culture, and yet, while naming the parsnip, makes no mention of the carrot,—if the word *pastinaca* really means the parsnip. I am willing to believe, however, that the *pastinaca* of Albertus

[1] Theophrastus, Bodæus a Stapel, ed. 1644, 1119, 1122.

[2] Pliny, lib. xx. c. 16; lib. xix. c. 27. [3] Matth., Op., 1598, 570.

Magnus is the *carrot*, for in the sixteenth century Ammonius[1] gives the name for the carrot *pastenei*, as applying to *Pastinaca sativa* and *agrestis*. Barbarus, who died in 1493, and Virgelius[2] both describe the carrot under the name Pastinaca; and Apicius,[3] a writer on cookery in the third century, gives directions for preparing the *Carota* seu *pastinaca*, which can only apply to the *carrot*. Dioscorides[2] uses the word *Carota* as applying to the *Pastinaca silvestris* in the first century. Columella[4] and Palladius[5] both mention the *pastinaca* as garden plants, but say nothing but what can better apply to the carrot than the parsnip. Macer Floridus[6] also treats of what may be the *carrot* under *Pastinaca*, and says no roots afford better food.

We hence believe that the carrot was cultivated by the ancients, but was not a very general food-plant, and did not attain the modern appreciation; that the word *pastinaca*, or *cariotam*, or *carota*, in these times was applied to both the cultivated and the wild form; and we suspect that the word *Gallicam*, used by Pliny in the first century, indicates that the cultivated root reached Italy from France, where now it is in such exaggerated esteem.

The *Sisaron* of Dioscorides and the *Siser* of Columella and Pliny may have been a form of the carrot, but we can attain no certainty from the descriptions. The fact that the grouping of the roots which occurs in the Skirret, into which authors translate Siser, is not mentioned by the ancients,—a distinction almost too important to be overlooked,—and that the short carrot was called *Siser* by botanists of the sixteenth century, are arguments in favor of the Siser being a carrot. On the other hand, we should scarcely expect a distinction being made between *Pastinaca* and *Siser*, were both as resembling in the plant as are the two forms of carrot at present.

The carrot is now found under cultivation and as an escape throughout a large portion of the world. In China it is noticed in the Yuan dynasty, as brought from Western Asia, 1280–1368,[7] and is classed as a kitchen vegetable in the sixteenth, seven-

[1] Ammonius, Med. Herb., 1539, 186.
[2] In Ruellius's Dioscorides, 1529, 174.
[3] Apicius, lib. iii. c. 21.
[4] Columella, lib. xi. c. 3.
[5] Palladius, lib. c. 24.
[6] Macer Floridus, De Viribus Herb., l. 1284, Sillig ed., 1832; Æmelius Macer, Pictorius ed., 1581, 95, but a parsnip figured by Pictorius.
[7] Bretschneider, On the Study, etc., 17.

teenth, and eighteenth centuries by various Chinese authors.[1] In India the carrot is said to have first come from Persia, and now cultivated in abundance in the Mahratta and Mysore countries.[2] The carrot is enumerated among the edible plants of Japan by Thunberg,[3] and earlier by Kaempfer.[4] The kind now described by a Japanese authority[5] are an inch and a half in diameter at the crown and nearly two feet and a half long, of a high color. It is now cultivated in the Mauritius, where it has also become spontaneous.[6] It is recorded in Arabia by Forskål,[7] and was seen growing—both the yellow and the red—by Rauwolf at Aleppo in the sixteenth century.[8] In Europe its culture was mentioned by nearly all the ancient herbalists and by writers on gardening subjects, the red or purple kind finding mention by Ruellius[9] in 1536. In England the yellow and dark red, both long forms, are noticed by Gerarde[10] in 1597, and the species is supposed to have been introduced by the Dutch in 1558.[11] In the "Surveyors' Dialogue," 1604, it is stated that carrot-roots are then grown in England, and sometimes by farmers.[12] In the New World carrots are mentioned at Margarita Island by Hawkins in 1565[13] (and this implies that they were well known in England at this date); are mentioned in Brazil by Nieuhoff in 1647;[14] in Virginia in 1609[15] and 1648;[16] and in Massachusetts in 1629.[17] In 1779 carrots were among the Indian foods destroyed by General Sullivan near Geneva, N. Y.[18] So fond of carrots are the Flathead Indians, of Oregon, that the children cannot forbear stealing them from the fields, although honest as regards other articles.[19]

The types of the modern carrot are the tap-rooted and the premorse-rooted, with quite a number of sub-types, which are

[1] Bretschneider, Bot. Sin., 59, 83, 85; also Smith, Mat. Med., 51.
[2] Ainslie, Mat. Med., i. 57.
[3] Thunberg, Fl. Jap., xxxiii. 117.
[4] Kaempfer, Amœn., 1712, 822.
[5] Kizo Tamari, Comm. to New Orleans Expos., Am. Hort., September, 1886, 9.
[6] Bojer, Hort. Maurit., 160.
[7] Forskål, Fl. Æg.-Arab., xciii.
[8] Gronovius, Orient., 32.
[9] Ruellius, De Nat. Stirp., 1536, 699.
[10] Gerarde, Herbal, 1597, 872.
[11] Booth, Treas. of Bot.
[12] Gard. Chron., 1853, 346.
[13] Hawkins, Voy. Hak. Soc., ed. 27.
[14] Nieuhoff, Hak. Voy.
[15] A True Decl. of Va., 1610, 13.
[16] A Perf. Descr. of Va., 1649, 4.
[17] Higginson, Mass. Hist. Soc. Coll., 1st ser., i. 118; Wood, New Eng. Prosp., 1st ed., ii.
[18] Conover, Early Hist. of Geneva, 47.
[19] Pacific R. R. Rept., i. 295.

very distinct in appearance. The synonymy in part is as below. First, for the sharp-pointed forms, which are ancient,—

I. *The long, taper-pointed forms.*

Pastinaca sativa prima. Fuch., 1542, 682 (very little improved).
Moren. Roszlin, 1550, 106.
Staphylinus. Tragus, 1552, 442.
Carota. Cam. Epit., 1586, 509 (very highly improved); Matth., 1598, 549.
Pastinaca sativa Diosc. Daucus Theophrasti. Lob. ic., 1591, i. 720.
Pastinaca sativa atrorubens. Lob. ic., l. c., 723.
Pastinaca sativa tenuifolia. Ger., 1597, 872.
Pastinaca tenuifolia sativa. Dod., 1616, 678.
Pastinaca sativa rubens. Dod., 1616, 678.
Long yellows, reds, and whites of modern growing.

II. *The half-long, taper-pointed forms.*

? Pastinaca sativa altera. Fuch., 1542, 683 (very poor).
Siser. Matth. Com., 1558, 242; Pin., 1561, 147.
Siser alterum. Cam. Epit., 1586, 227.
Carota. Cast. Dur., 1617, 95.
Blanche des Vosges. Vilmorin, 1883, 70.
Danvers half-long of American gardens.

The premorse forms offer a number of sub-types which are very distinct, some being nearly spherical, others cylindrical, and yet others tapering, but all ending abruptly at the base, the tap-root starting from a flat, or nearly flat, surface. Their appearance seems to be modern.

I. The *spherical.* The earliest mention I find of this type is in France in 1824, 1826, and 1829,—the *Courte de Pollande.*[1] It is figured by Decaisne & Naudin,[2] and, in a more improved form, by Vilmorin in 1883.[3]

II. The *cylindrical.* The carrots of this type are remarkably distinct, and have for types the Carentan and the Coreless of Vilmorin. The first was in American seed-catalogues in 1878.

III. The *tapering.* Quite a number of varieties belong to this class, of which the Early Horn is the type. This was mentioned for American gardens by McMahon[4] in 1806, and by succeeding authors.

[1] L'Hort. Fran., 1824; Petit, Dict. du Jard., 1826; Noisette, Man., 1829.
[2] Decaisne & Naudin, Man., iv. 125. [3] Vilmorin, Les Pl. Pot., 1883, 62.
[4] McMahon, Am. Gard. Cal., 1806, 313.

In view of the confusion in early times in the naming of the carrot, it is desirable to offer a list of the names used by various authors, with the dates. The first, or long carrot, was called, in England, *carrot*, Lyte, 1586; in France, *carota*, Ruel., 1536, *carrottes*, *pastenades*, Pin., 1561, *pastenade jaulne*, *pastenade rouge*, Lyte, 1586, *carotte*, *racine jaulne*, Ger., 1597; in Germany, *Pastenei*, Ammon., 1539, *Pastiney*, *Pastinachen*, Fuch., 1542, *geel Ruben*, *rohte Ruben*, *weissen Ruben*, Trag., 1552, *Mohren*, Rosz., 1550, *Moren*, Pin., 1561, *gelbe Ruben*, *weissen Ruben*, Rauwolf, 1582, *rot Mohren*, *weisse Mohren*, Cam., 1586; in Dutch, *geel peen*, *pooten*, *geel mostilen*, *caroten*, Lyte, 1586; in Italy, *carota*, Pin., 1561, *carota* and *carotola*, Cam., 1586, *pastinaca*, Ger., 1597, Dod., 1616; in Spain, *canahoria*, Ger., 1597, and *pastenagues*, *cenoura*, Dod., 1616.

The half-long, taper-pointed carrot was called *Siser* by Matthiolus in 1558; in French, *carottes blanche*, Pin., 1561; but his other names applicable to the Skirret are the *chervy*, *giroles* aut *carottes blanches*, Cam. Epit., 1586; in Germany, *Gierlin* sive *Girgellin*, Cam., 1586; in Italy, *carota bianca*, Cam., 1586, *carotta*, *carocola*, Cast. Dur., 1617; in Spain, *chirivias*, Cam., 1586, who says planted in gardens and even in fields throughout Germany and Bohemia.

The modern names for the carrot, in Europe, are, in France, *carotte*, *faux-chervis*, *girouille*, *pastenade*; in Germany, *Mohre*, *Gelbrube*, *Carotte*; in Flanders, *wortel*; in Holland, *wortel*, *peen*; in Denmark, *guleroden*; in Italy, *carota*; in Spain, *zanahoria*; in Portugal, *cenoura*;[1] in Greece, *karotta*, or *staphulona*.[2]

In extra-European countries: in Arabic, *gezar*,[3] *istufleen*, *juzir-ul-bostance*; in Bengali, *gajar*; in Egypt, *djazar*; in India, *gager*;[4] in Japan, *kofuk*, vulgo *nisji* et *jabu nensin*;[5] in Persia, *zardak*; in Sanscrit, *grinjuna*, *canjara*; in Telugu, *gazeragedda*.

The various forms of the carrot have probably their prototypes in nature, but as yet the evidence is a little deficient. We may suspect the general resemblance of the *Altringham* to the Japanese variety already mentioned may be somewhat more than accidental, and to signify the original introduction of this variety from Japan. We have, in the attempts at amelioration, noted

[1] Vilmorin, l. c., 60.
[2] Pickering, Ch. Hist., 190.
[3] Delile, Fl. Ægypt, illust.
[4] Birdwood, Veg. Prod. of Bomb., 162.
[5] Kaempfer, Amœn., 1712, 822; Thunb., Jap., 117.

the appearance of forms of similar types as those under cultivation.[1] The presumptive evidence is in favor of the view that all cultivated types are removes from nature, not new originations by man; yet the proof is not as decisive as could be wished.[2]

(To be continued.)

REVIEW OF THE PROGRESS OF NORTH AMERICAN PALÆONTOLOGY FOR THE YEAR 1886.

BY JOHN BELKNAP MARCOU.

THE year which has just passed has been fairly prolific in palæontologic works and promises well for the future of American palæontology. With the exception of the death of the veteran palæontologist and conchologist, Isaac Lea, of Philadelphia, we have to deplore the loss of no eminent workers in this branch of science.

I have extended this review so as to include the vertebrates, which I had not touched in my similar work for previous years, and, although my slighter acquaintance with the subject has made it much more difficult for me to get the material together, I trust that it will be found a welcome addition by those interested in this branch of the science.

T. H. Aldrich publishes a "Preliminary Report upon the Tertiary Fossils of Alabama and Mississippi" in the *Geol. Sur. Alabama*, Bull. No. 1, p. 18. In the *Jour. Cincinnati Soc. Nat. His.*, vol. viii. p. 256, he has "Notes on the Distribution of Tertiary Fossils in Alabama and Mississippi."

J. A. Allen has an article "On an Extinct Type of Dog from Ely Cave, Lee County, Va.," in the *Mem. Mus. Comp. Zool.*, at Harvard College, vol. x. p. 1. Professor Shaler appends a note, from which one would infer that he considers the remains described to be of Pliocene age.

H. M. Ami, in the *Canad. Rec. Sci.*, vol. ii. p. 304, has a note "On the Occurrence of *Scolithus* in Rocks of the Chazy Formation about Ottawa, Ontario."

Charles A. Ashburner and Angelo Heilprin have, in the *Proc.*

[1] Joigneaux, Traite des Graines, 44.

[2] See Proc. of Soc. for P. of Agr. Sc., 1886, p. 68, for an article of mine on this subject.

and Collections Wyoming His. and Geol. Soc., vol. ii. p. 254, an article entitled "Report on the Wyoming Valley Carboniferous Limestone Beds, by C. A. Ashburner, Geologist in Charge of the Anthracite Survey, and Corresponding Member of the Wyoming Historical and Geological Society, accompanied by a Description of the Fossils contained in the Beds, by Angelo Heilprin."

L. W. Bailey has a "Report of Explorations and Surveys in Portions of the Counties of Carleton, Victoria, York, and Northumberland, New Brunswick, 1885," in the *Ann. Report Geol. and Nat. Surv. Canada*, new ser., vol. i. pp. 18–309.

Mariano Barcena, in the AMERICAN NATURALIST, vol. xx. p. 633, has a note on "The Fossil Man of Peñon."

W. H. Barris, in the *Proc. Davenport Acad. Nat. Sci.*, vol. v. p. 15, criticises a paper on the "Geology of Scott County, Iowa, and Rock Island County, Ill., by A. S. Tiffany."

G. Baur, in the *Morphologisches Jahrbuch*, Band xii. Heft 11, p. 299, has an article entitled "Ueber die Kanale im Humerus der Amnioten." In the *Biologisches Centralblatt*, Band vi. p. 353, he has "Ueber die Morphogenie der Wirbelsäule der Amnioten."

J. P. Bishop gives a notice "On Certain Fossiliferous Limestones of Columbia County, N. Y., and their Relation to the Hudson River Shales and the Taconic System" in the *Amer. Jour. Sci.*, 3d ser., vol. xxxii. p. 438.

F. Brauer, in the *Annalen des k.k. Naturhistorischen Hofmuseums*, redigirt von Franz Ritter von Hauer, Band i. No. 2, p. 87, criticises some of S. H. Scudder's works in an article entitled "Ansichten über die paläozoischen Insecten und deren Deutung."

W. C. Brögger, in an article called "Om alderen af Olenellus-zonen i Nordamerika," Geol. Forenings i Stockholm Forhand, No. 101, Bd. viii. H. 3, p. 182, attempts to prove that the Olenellus beds are older than the Paradoxides beds.

R. E. Call has an article "On the Genus *Campeloma Rafinesque*, with a Revision of the Species, Recent and Fossil," in the *Bull. Washburn College Laboratory Nat. His.*, vol. i. No. 5, p. 159.

E. Canu has an article on "L'articulé problématique des dépôts tertiaires de Florrisant; *Planocephalus aselloides* Scudder," in the *Soc. Geol. du Nord. Annales*, vol. xii. p. 148.

P. H. Carpenter has a "Note on the Structure of Crotalocrinus" in the *Ann. and Mag. Nat. His.*, 5th ser., vol. xviii. p. 397.

R. Chalmers has a "Preliminary Report on the Surface Geology of New Brunswick" in the *Ann. Report Geol. and Nat. His. Surv. Canada*, new ser., vol. i. p. 1, gg.

E. W. Claypole, in the *Proc. and Coll. Wyoming Hist. and Geol. Soc.*, vol. ii. pt. 2, p. 239, has a "Report on Some Fossils from the Lower Coal-Measures near Wilkesbarre, Luzerne County, Pa."

E. A. Congdon has "Remarks upon a Deposit of Infusorial Earth on the South Shore of Clove Lake, Staten Island," in the *Proc. Nat. Sci. Assoc. Staten Island*, May 8, 1886.

E. D. Cope has "Second Continuation of Researches among the Batrachia of the Coal-Measures of Ohio" in the *Proc. Amer. Phil. Soc.*, vol. xxxii. p. 405. In the *Trans. Vassar Bro. Inst.*, vol. iii. pt. 1, p. 60, he has an address entitled "The Genealogy of the Vertebrata as learned from Palæontology." He has notes on "The Sternum of the Dinosauria;" "Corrections of Notes on the Dinocerata," in the AMERICAN NATURALIST, vol. xx. pp. 153 and 155. In the *Geol. Mag.*, new ser., Decade iii. vol. iii. p. 49, is an article entitled "Prof. E. D. Cope on a New Type of Perissodactyle Ungulate from the Wasatch Eocene of Wyoming Territory, United States of America;" on p. 141 of the same magazine he has a note on "Edestus and Pelecopterus." In the AMERICAN NATURALIST, vol. xx. p. 367, he has a note on "The Vertebrate Fauna of the Ticholeptus Beds;" on p. 451 he has an article on "The Plagiaulacidæ of the Puerco Epoch." In the *Geol. Mag.*, new ser., Decade iii. vol. iii. p. 238, he has "Notes on Phenacodus;" on p. 239 he has a "Note on Erisichthe." He has a report on the "Vertebrata of the Swift Current Creek Region of the Cypress Hills" in the *Ann. Rep. Geol. and Nat. Hist. Surv. Canada*, 1885, published May, 1886. He has a note on "The Long-spined Theromorpha of the Permian Epoch" in the AMERICAN NATURALIST, vol. xx. p. 544; on p. 611 he has an article on "The Phylogeny of the Camelidæ;" on p. 1027 he has "An interesting Connecting Genus of Chordata;" on p. 1044 he describes "A Giant Armadillo from the Miocene of Kansas." In the *Trans. Amer. Philos. Soc. Philad.*, vol. xii., 2d ser., p. 243, he has an article "On the Intercentrum of the Terrestrial Vertebrata." He also published a book on "The Origin of the Fittest, Essays on Evolution," published in New York. In the *Trans. Am. Phil. Soc.*, vol. xvi. p. 285, he has a "Systematic Catalogue

of Species of Vertebrata found in the Beds of the Permian Epoch in North America, with Notes and Descriptions." In the *Proc. Amer. Phil. Soc.* for 1885, p. 234, he has an article "On the Structure of the Brain and Auditory Apparatus of a Theromorphous Reptile of the Permian Epoch."

F. W. Cragin has "Notes on the Geology of Southern Kansas" in the *Bull. Washburn College Laboratory Nat. Hist.*, vol. i. No. 3, p. 85.

K. M. Cunningham, in *Science*, vol. vii. p. 35, calls attention to a "New Find of Fossil Diatoms."

T. Nelson Dale, in the *Proc. Canadian Inst.*, 3d ser., vol. iv. p. 69, has a note on "New England Upper Silurian."

James D. Dana, in the *Proc. A. A. A. Sci.*, vol. xxxiv. p. 216, and in the *Amer. Jour. Sci.*, 3d ser., vol. xxxi. p. 241, has an article "On Lower Silurian Fossils from a Limestone of the Original Taconic of Emmons." In the *Amer. Jour. Sci.*, 3d ser., vol. xxxii. p. 236, he has a note on "The Taconic Stratigraphy and Fossils."

Nelson H. Darton, in *Sci.*, vol. vii. p. 78, has a note entitled the "Taconic Controversy in a Nutshell." In the *Amer. Jour. Sci.*, 3d ser., vol. xxxi. p. 209, he has an article "On the Area of Upper Silurian Rocks near Cornwall Station, Eastern Central Orange County, N. Y."

W. Davies, in the *Geol. Mag.*, new ser., Decade iii. vol. iii. p. 141, has a "Note on Prof. E. D. Cope's article upon Edestus and Pelecopterus, etc."

Sir J. W. Dawson has an abstract of a paper "On the Fossil Flora of the Laramie Series of Western Canada" in the AMERICAN NATURALIST, vol. xx. p. 635, and in the *Amer. Jour. Sci.*, 3d ser., vol. xxxii. p. 242. In the *Geol. Mag.*, new ser., Decade iii. p. 503, he has an abstract of a paper "On Canadian Examples of Supposed Fossil Algæ."

William B. Dwight, in the *Amer. Jour. Sci.*, 3d ser., vol. xxxi. p. 125, has an article on "Recent Explorations in the Wappinger Valley Limestone of Dutchess County, N. Y., No. 5, Discovery of Fossiliferous Potsdam Strata at Poughkeepsie, N. Y.," and a note on this subject is also placed in the *Proc. A. A. A. S.*, vol. xxxiv. pt. 1, p. 204.

R. W. Ellis has a "Report on the Geological Formations of Eastern Albert and Westmoreland Counties, New Brunswick,

and of Portions of Cumberland and Colchester Counties, Nova Scotia, embracing the Spring Hill Coal Basin and the Carboniferous System north of the Cobequid Mountains," in the *Geol. and Nat. Hist. Surv. Canada Ann. Rep.*, new ser., vol. i. p. 1 e.

Robert Etheridge, Jr., and P. Herbert Carpenter have published a "Catalogue of the Blastoidea in the Geological Department of the British Museum (Natural History), with an Account of the Morphology and Systematic Position of the Group and a Revision of the Genera and Species;" in this many American forms are described and discussed.

John Eyerman, in the *American Jour. Sci.*, 3d ser., vol. xxxi. p. 72, has a note on "Footprints on the Triassic Sandstone (Jura-Trias) of New Jersey."

Charles L. Faber has some "Remarks on Some Fossils of the Cincinnati Group" in the *Jour. Cincinnati Soc. Nat. Hist.*, vol. ix. p. 14.

H. Filhol has "Observations sur le mémoire de M. Cope intitulé Relations des Horizons renfermant des débris d'animaux vertébrés Fossiles en Europe et en Amérique" in the *Ann. Sci. Geol.*, vol. xvii. p. 1.

S. W. Ford has "Notice of a New Genus of Lower Silurian Brachiopoda," and "Note on the recently proposed Genus Billingsia," in the *Amer. Jour. Sci.*, 3d ser., vol. xxxi. p. 466, and vol. xxxii. p. 325. He has also published a "Note on the Age of the Swedish Paradoxides Beds" in the *Amer. Jour. Sci.*, 3d ser., vol. xxxii. p. 473. In connection with W. B. Dwight he has published a "Preliminary Report of S. W. Ford and W. B. Dwight upon Fossils obtained in 1885 from Metamorphic Limestones of the Taconic Series of Emmons, at Canaan, N. Y. (A) Explanatory Statements with Reference to the Palæontological Investigations at Canaan, N. Y., by W. B. Dwight. (B) Joint Report on the Fossils" in the *American Jour. Sci.*, 3d ser., vol. xxxi. p. 248.

A. F. Foerste describes the fossils of "The Clinton Group of Ohio" in the *Bull. Sci., Laboratories Denison University*, vol. i. p. 63.

C. E. Grant and Sir J. W. Dawson have "Notes on Pleistocene Fossils from Anticosti" in the *Can. Rec. Sci.*, vol. ii. p. 44.

L. P. Gratacap has a note on "Fish Remains and Tracks in the Triassic Rocks at Weehawken, N. J.," in the AMERICAN NATURALIST, vol. xx. p. 243.

James Hall has "Bryozoa of the Upper Helderberg Group, Plates and Explanations. Published in advance of the Report of the State Geologist for 1886, and of vol. vi., Pal. N. Y., 1886, pls. i.–xii. pp. 1–29. Albany, 1886."

F. L. Harvey has a note "On *Anthracomartus trilobitus* Scudder" in the *Proc. Acad. Nat. Sci. Philada.*, p. 231, September, 1886.

Angelo Heilprin has "Notes on the Tertiary Geology and Palæontology of the United States" in the *Proc. Acad. Nat. Sci.*, p. 57, March, 1886, Philadelphia. In the *Trans. Wagner Free Institute Sci.*, p. 65, Philad., 1886, he has "Explorations on the West Coast of Florida and in the Okeechobee Wilderness, with Special Reference to the Geology and Zoology of the Floridian Peninsula. A Narrative of Researches undertaken under the Auspices of the Wagner Free Institute of Science of Philadelphia." Many new species without illustrations are described in this paper. He has also a note "On Miocene Fossils from Southern New Jersey" in the *Proc. Acad. Nat. Sci. Philad.*, p. 351, December, 1886.

L. E. Hicks has a note on "The Permian in Nebraska" in the AMERICAN NATURALIST, vol. xx. p. 881.

E. W. Hilgard has a note on "Dr. Otto Meyer and the Southwestern Tertiary" in *Science*, vol. vii. p. 11. In the *Amer. Jour. Sci.*, 3d ser., vol. xxxi. p. 398, is an abstract of a paper entitled "Making Deposits of the Remains of Birds, Squirrels, and other Small Animals," from William's "Mineral Resources of the United States for the Years 1883–4."

Franklin C. Hill has an article "On the Mounting of Fossils" in the AMERICAN NATURALIST, vol. xx. p. 353.

G. J. Hinde, in *Ann. and Mag. Nat. Hist.*, p. 271, March, 1886, has an article on "*Hystricrinus* Hinde versus *Arthroacantha* Williams, a Question of Nomenclature."

Arthur Hollick publishes "Remarks on Some Fossil Leaves from Kreischerville and New Jersey" in the *Proc. Nat. Sci. Assoc. Staten Island*, February 13, 1886.

Joseph F. James has "Cephalopoda of the Cincinnati Group;" "Description of a New Species of Gomphoceras from the Trenton of Wisconsin;" and "Note on a Recent Synonyme in the Palæontology of the Cincinnati Group," in the *Jour. Cin. Soc. Nat. Hist.*, vol. viii. pp. 235 and 255, and vol. ix. p. 39.

T. Rupert Jones has an article "On Palæozoic Phyllopoda," and one "On Some Fossil Ostracoda from Colorado," in the *Geol. Mag.*, new ser., Decade iii. vol. iii. pp. 456 and 145.

Geo. F. Kunz has an article on "Agatized and Jasperized Wood of Arizona" in the *Pop. Sci. Monthly*, vol. xxviii. p. 362.

G. W. Lamplugh, in the *Quart. Jour. Geol. Soc. London*, vol. xlii. pt. 3, p. 276, has an article "On Glacial Shell Beds in British Columbia."

D. W. Langdon publishes "Observations on the Tertiary of Mississippi and Alabama, with Descriptions of New Species," in the *Amer. Jour. Sci.*, 3d ser., vol. xxxi. p. 202.

Joseph Leidy has "Mastodon and Llama from Florida;" "An Extinct Boar from Florida;" and "Caries in the Mastodon," in *Proc. Acad. Nat. Sci. Phila.*, pp. 11, 37, and 38, March, 1886.

Lennox has a note on "The Fossil Sharks of the Devonian" in the *Proc. Canadian Inst.*, 3d ser., vol. iii. p. 120.

Richard Lydekker has published "Catalogue of the Fossil Mammalia in the British Museum (Natural History), Cromwell Road S. W., part iii., containing the Order Ungulata, suborders Perissodactyla, Toxodontia, Condylarthra, and Amblypoda." This contains many American species.

A. McCharles has published a paper entitled "The Extinct Cuttle-Fish in the Canadian Northwest. A Paper read before the Canadian Institute, Toronto, March 4, 1885."

John Belknap Marcou has published "Department of the Interior, U. S. National Museum, Serial No. 40, *Bulletin of the United States National Museum*, No. 30, published under the direction of the Smithsonian Institution. Bibliographies of American Naturalists, III. Bibliography of Publications relating to the collection of Fossil Invertebrates in the United States National Museum, including Complete Lists of the Writings of Fielding B. Meek, Charles A. White, and Charles D. Walcott. Washington, 1885." Four hundred copies of an extract from this were published under the title "Annotated Catalogue of the Published Writings of Charles Abiathar White, 1860–1885. Extracted from *Bull. 30, U. S. National Museum*, pp. 11–181, 1885." In the *Proc. U. S. Nat. Mus.*, vol. ix. p. 250, he has a "Supplement to the List of Mesozoic and Cenozoic Invertebrate Types in the Collections of the National Museum." In the AMERICAN NATURALIST, vol. xx. p. 505, he has a "Review of the Progress

of North American Invertebrate Palæontology for 1885;" and, finally, a "Record of North American Invertebrate Palæontology for the Year 1885, from the Smithsonian Report for 1885. Washington, 1886."

George F. Matthew has "Illustrations of the Fauna of the St. John Group continued, No. 3. Descriptions of New Genera and Species (including a Description of a New Species of Solenopleura, by J. F. Whiteaves)," in the *Proc. and Trans. Roy. Soc. Canada* for the year 1885, vol. iii. section iv. p. 29. He has a "Synopsis of the Fauna in Division 1, of the St. John Group, with Preliminary Notes on the Higher Faunas of the same Group;" in the *Bull. Nat. His. Soc. New Brunswick*, No. 5, p. 25, he publishes a note on "The Structural Features of *Discina acadica* (Hartt) of the St. John Group," and one on the "Discovery of a Pteraspidian Fish in the Silurian Rocks of New Brunswick," in the *Canadian Rec. Sci.*, vol. ii. No. 1, p. 9, and No. 4, p. 251. In the *Amer. Jour. Sci.*, 3d ser., vol. xxxi. pp. 72 and 472, he has a "Pteropod of the St. John Group (from a Letter by Mr. G. F. Matthew, dated St. John, New Brunswick, December 8)," and a "Note on the Occurrence of *Olenellus kjerulfi* in America." He has an "Additional Note on the Pteraspidian Fish found in New Brunswick" in the *Canad. Rec. Sci.*, vol. v. No. 5, p. 323.

Otto Meyer and T. H. Aldrich have published in the *Jour. Cin. Soc. Nat. His.*, vol. ix. p. 40, an article on "The Tertiary Fauna of Newton and Wautubbee, Miss."

Otto Meyer, in the *Geol. Sur. Alabama*, Bull. No. 1, pt. 2, p. 63, has "Contributions to the Eocene Palæontology of Alabama and Mississippi." In the *Amer. Jour. Sci.*, 3d ser., vol. xxxii. p. 20, he has "Observations on the Tertiary and Grand Gulf of Mississippi." In the AMERICAN NATURALIST, vol. xx. p. 637, he has "Notes on the Variation of Certain Tertiary Fossils in Overlying Beds."

Fred. K. Mixer and Herbert U. Williams have a note on "Fish Remains from the Corniferous near Buffalo" in the *Bull. Buffalo Soc. Nat. Sci.*, vol. v. p. 84.

D. R. Moore has an article on "Fossil Corals of Franklin County, Indiana," in the *Bull. Brookville Soc. Nat. His.*, No. 2, p. 50; and in No. 1, p. 44, he has "Two Hours among the Fossils of Franklin County, Ind."

Charles Morris has an article on "Methods of Defence in

Organisms" in the *Proc. Acad. Nat. Sci. Philada.*, p. 25, March, 1886.

J. S. Newberry, in the *Bull. Torrey Botanical Club*, vol. xiii. pp. 33 and 77, has "The Flora of the Amboy Clays," and "Description of a Species of Bauhinia from the Cretaceous Clays of New Jersey." In the *Trans. N. Y. Acad. Sci.*, vol. v. p. 133, he has an abstract of a paper on "The Cretaceous Flora of North America, Illustrated by Drawings and Lantern Views."

H. Allyne Nicholson has an article "On Some New or Imperfectly-known Species of Stromatoporoids" in *Ann. and Mag. Nat. Hist.*, 5th ser., vol. xviii. p. 8, London. Several American species are described. He has also published "A Monograph of the British Stromatoporoids, pt. 1, General Introduction. The Palæontological Society, Instituted 1847, vol. for 1885. London, 1886."

Henry F. Osborn has "A New Mammal from the American Triassic" in *Science*, vol. viii. p. 540. In the *Proc. Acad. Nat. Sci.*, p. 359, December, 1886, he has "Observations upon the Upper Triassic Mammals, Dromatherium and Microconodon."

Richard Owen has an article "On a New Perissodactyle Ungulate from Wyoming" in the *Geol. Mag.*, new series, Decade iii. vol. iii. p. 140.

A. S. Packard has an article on "Geological Extinction and some of its Apparent Causes," and on the "Discovery of Lamellate Thoracic Feet in the Phyllocarida" in the AMERICAN NATURALIST, vol. xx. pp. 29 and 155, and in the *Proc. Amer. Phil. Soc. Philad.*, vol. xxiii. p. 380.

J. Hayes Panton has "Fragmentary Leaves from the Geological Records of the Great Northwest;" "Gleanings from the Geology of the Red River Valley;" "Gleanings from Outcrops of Silurian Strata in the Red River Valley;" and "Notes on the Geology of Some Islands in Lake Winnipeg," in the *Manitoba Hist. and Sci. Soc. Winnipeg Trans.*, Nos. 4, 3, 15, and 20.

Julius Pohlman has an article on "Fossils from the Waterlime Group near Buffalo, N. Y.," in the *Bull. Buffalo Soc. Nat. Sci.*, vol. v. p. 23.

F. W. Putnam has a note on the "Discovery of a Mastodon Skull at Shrewsbury" in the *Proc. Boston Soc. Nat. Hist.*, vol. xxiii. p. 242.

H. Rauff has a note "On the Genus Hindia Dunc." in the *Ann. and Mag. Nat. Hist.*, 5th ser., vol. xviii. p. 169.

Eugene N. S. Ringueberg has descriptions of "New Genera and Species of Fossils from the Niagara Shales" in the *Bull. Buffalo Soc. Nat. Sci.*, vol. v. p. 1.

C. Rominger has an article "On the Minute Structure of Stromatopora and its Allies" in the *Proc. Acad. Nat. Sci. Phila.*, p. 39, March, 1886.

Oscar Schmidt has published in the *International Scientific Series* "The Mammalia in their Relation to Primeval Times. New York, 1886;" this is a translation of his German work.

W. B. Scott has an article "On Some New Forms of Dinocerata" in the *Amer. Jour. Sci.*, 3d ser., vol. xxxi. p. 303.

S. H. Scudder, in the *Mem. Boston Soc. Nat. Hist.*, vol. iii. No. 13, pp. 431, 438, and 439, has "The Oldest Known Insect Larva, *Mormolucoides articulatus*, from the Connecticut River Rocks;" "Note on the supposed Myriopodan Genus Trichiulus;" and "A Review of Mesozoic Cockroaches." He has also published an article entitled "The Cockroach of the Past," reprinted from "The Structure and Life History of the Cockroach (*Periplaneta orientalis*), by L. C. Miall and Alfred Denny, pp. 205–219. London, 1886." In the *Amer. Jour. Sci.*, 3d ser., vol. xxxi. p. 310, he describes a "New Carboniferous Arachnidan from Arkansas." *Bull. U. S. Geol. Surv.*, No. 31, is a "Systematic Review of our Present Knowledge of Fossil Insects, including Myriapods and Arachnids;" this appeared first in German as a portion of "Zittel's Handbuch der Paleontologie," I. Abtheilung Paleozoologie, Bd. ii. p. 721.

H. M. Seely has a note on "The Genus Strephochetus, Distribution and Species," in the *Amer. Jour. Sci.*, 3d ser., vol. xxxii. p. 31.

N. S. Shaler has a "Preliminary Report on the Geology of the Cobscook Bay District, Maine. Published by permission of the Director of the U. S. Geol. Survey," in the *Amer. Jour. Sci.*, vol. xxxii. p. 35.

A. H. Smith has a note on "The Railway Cutting at Gray's Ferry Road" in the *Proc. Acad. Nat. Sci. Phila.*, p. 253, September, 1886.

M. Stirrup has an article "On Some Fossils from the Palæozoic Rocks of America, principally from the State of Indiana," in the *Manchester Geol. Soc. Trans.*, vol. xviii. p. 331.

T. Thorell has an article "On *Proscorpius osbornei* Whitfield" in the AMERICAN NATURALIST, vol. xx. p. 269.

A. S. Tiffany has a work on the "Geology of Scott County, Iowa, and Rock Island County, Ill., and the Adjacent Territory, showing the Geographical and Vertical Range of the Fossils of the Niagara Corniferous and Hamilton Groups of Rocks, and the Chemung Group at Burlington, Iowa, with Supplement. Davenport, Iowa, 1885."

E. O. Ulrich has "Descriptions of New Silurian and Devonian Fossils, Contributions to American Palæontology, vol. i. p. 3, May, 1886, Cincinnati." He has a "Report on the Lower Silurian Bryozoa, with Preliminary Descriptions of some of the New Species," and "Remarks upon the Names *Cheirocrinus* and *Calceocrinus*, with Descriptions of three New Generic Terms and one New Species," in the *14th Ann. Rep. Geol. and Nat. Hist. Surv. Minnesota*, pp. 57 and 104.

Charles Wachsmuth and Frank Springer have published "Revision of the Palæocrinoidea, Part III. Discussion of the Classification and Relations of the Brachiate Crinoids, and Conclusion of the Generic Descriptions, Second Section," in the *Proc. Acad. Nat. Sci. Phila.*, p. 65, March and September, 1886. The author's edition contains, in addition to the article in the *Proceedings*, an index of all generic and specific names used in connection with the Palæocrinoidea.

M. E. Wadsworth has a note "On a Supposed Fossil from the Copper-Bearing Rocks of Lake Superior" in the *Proc. Boston Soc. Nat. His.*, vol. xxiii. p. 208.

C. D. Walcott has an article on the "Classification of the Cambrian System of North America" in the *Amer. Jour. Sci.*, 3d ser., vol. xxxii. p. 138. He has also published a "Second Contribution to the Cambrian Faunas of North America," *Bull. 30, U. S. Geol. Surv.* Washington, 1886.

L. F. Ward has a "Note on a few Imperfect Leaf Impressions from Northern California" in *Bull. U. S. Geol. Surv.*, No. 33, p. 16. In the *Amer. Jour. Sci.*, 3d ser., vol. xxxi. p. 370, he has a note "On the Determination of Fossil Dicotyledonous Leaves."

C. A. White has published "On the Fresh Water Invertebrates of the North American Jurassic," *Bull. U. S. Geol. Surv.*, No. 29, Washington, 1886, and "On the Relation of the Laramie Molluscan Fauna to that of the Succeeding Fresh-Water Eocene and other Groups," *Bull. U. S. Geol. Surv.*, No. 34. Washington, 1886.

R. P. Whitfield has a reply to Professor Thorell's criticism, entitled "Professor Thorell and the American Silurian Scorpion," in *Science*, vol. vii. p. 216. He has published "Brachiopoda and Lamellibranchiata of the Raritan Clays and Greensand Marls of New Jersey," *Monographs of the U. S. Geol. Surv.*, vol. ix. Washington, 1885; this appeared also as a publication of the *Geol. Surv. of New Jersey*. Trenton, 1886. In the *Bull. Amer. Mus. Nat. Hist.*, vol. i. p. 293, he has a "Notice of Geological Investigations along the Eastern Shore of Lake Champlain, conducted by Prof. H. M. Seely and Presdt. Ezra Brainerd, of Middlebury College, with Descriptions of the New Fossils discovered by R. P. Whitfield." In the AMERICAN NATURALIST, vol. xx. p. 1041, he has a notice on the same subject. In the *Bull. Amer. Mus. Nat. Hist.*, vol. i. p. 346, he has also a "Notice of a New Fossil Body, probably a Sponge related to Dictyophyton."

H. S. Williams has a criticism of Prof. James Hall's "Palæontology," vol. v. part i., entitled "Devonian Lamellibranchiata and Species-making," in the *Amer. Jour. Sci.*, 3d ser., vol. xxxii. p. 192. In the *Proc. A. A. A. S.*, vol. xxxii. part i. p. 222, he has an article "On the Classification of the Upper Devonian."

H. N. Williams has "Notes on the Fossil Fishes of the Genessee and Portage Black Shales" in the *Bull. Buffalo Soc. Nat. Sci.*, vol. v. p. 81.

S. G. Williams has "Westward Extension of Rocks in the Lower Helderberg Period in New York" in the *Proc. A. A. A. S.*, vol. xxxiv. part i. p. 235, and "The Westward Extension of Rocks of Lower Helderberg Age in New York" in the *Amer. Jour. Sci.*, 3d ser., vol. xxxi. p. 139.

N. H. Winchell has a "Notice of Lingula and Paradoxides from the Red Quartzites of Minnesota, Abstract," in the *Proc. A. A. A. S.*, vol. xxxiv. part i. p. 214. "The Taconic Controversy in a Nutshell" in *Science*, vol. vii. p. 34. He describes "New Species of Fossils" in the *14th Annual Rep. Geol. and Nat. His. Surv. Minnesota* for the year 1884, p. 313, and gives a list of "Specimens Registered in the General Museum in 1885" on pp. 125–6.

A. Woodward has published "The Bibliography of the Foraminifera, Recent and Fossil, including Eozoon and Receptaculites, 1565–January 1, 1886," in the *14th Annual Rep. Geol. and Nat. Hist. Surv. Minnesota* for the year 1885, p. 167.

L. Woolman has a note on the "Oriskany Sandstone in Lycoming County, Pa.," in the *Proc. Acad. Nat. Sci. Philad.*, p. 296, September, 1886.

THE DIPNOAN BRAIN.[1]

BY BURT G. WILDER.

THIS paper includes an account of the brain of *Ceratodus* (*Neoceratodus* Gill), substantiated by photographs and preparations of three unusually well-preserved specimens in the Museum of Cornell University; an admission of the writer's own earlier errors in respect to the brains of "fishes," especially in disregarding the membranous portions of the cœlian parietes; a criticism of Huxley's paper in the *Zool. Soc. Proc.*, January 4, 1876 (the later paper of Beauregard does not discuss the *structure* of the brain); a tabular statement of the resemblances and differences between the Dipnoi and other groups, particularly the Plagiostomes and Amphibia; a reiteration of belief (*Am. Assoc. Proc.*, 1875, 189) in the paramount value of cardiac and encephalic characters for the discrimination of more comprehensive groups; a reference to the morphological significance of the *aula* or mesal division of the prosocœle; a list of points requiring further investigation.

The brain of *Ceratodus* agrees with that of *Protopterus* (as described and figured by Fulliquet in the *Recueil Zool. Suisse* for 1886, and as seen in a recent dissection by the writer) in the important point that *the prosencephal consists mainly of a pair of large lobes whose cavities* (*procœles or "lateral ventricles"*) *are connected only by a comparatively small aula*, as in Amphibia and the higher vertebrates. Unlike *Protopterus*, however, between the dorsal parts of these lobes there is a *long and thick supraplex*, which, through an interruption of the proper nervous parietes for nearly the whole length, sends into each lobe a prolongation covered, like all plexes, by the lining endyma. In mammals,

[1] Abstract of a paper "On the Brain of *Ceratodus*, with Remarks upon Classification and the General Morphology of the Vertebrate Brain," read, by invitation, before the National Academy of Sciences, April 22, 1887.

birds, and reptiles such an interruption for plexal intrusion, when it exists, extends *caudad* from the porta or lateral orifice of the aula, and is known as the *rima* ("great transverse fissure" of anthropotomy). In *Ceratodus* alone, so far as known to the writer, is there a *prerima*,—that is, a rima extending *cephalad* from the margin of the porta. The brain examined by Huxley was evidently ill preserved; the supraplex was mistaken for a *tela vasculosa* (the writer's *aulatela*). Finally, it would appear that the margins of the rima on each side, after the supraplex was pulled out, were supposed to be artificial, so as to lead to the supposition that the dorsal portions of the cavities of the lateral lobes formed a single large "*ventriculus communis*." In the writer's specimens the lobes are separated as high as the plexus by a firm, membranous *quasi-falx*, and the prosencephalic region of the cranial floor presents a distinct mesal ridge, which is absent in *Protopterus*. In *Ceratodus* the olfactory lobes are pedunculated instead of sessile, as in *Protopterus;* but in both genera (and apparently also in *Lepidosiren*) they lie in the plane of the general brain-axis, and the proper cerebral outgrowths are ventral in position instead of dorsal, as in the Amphibia, Reptiles, Birds, and Mammals. Among other features not before recorded of *Ceratodus* is the *precommissure* and a thick *valvula* reaching more than half-way to the floor of the encephalocœle (general cavity of the brain). The conarium is very large and saccular, and closely attached to the supraplex. As stated by Huxley, the tip of the conarium is lodged in a distinct depression (the conarial fossa) in the roof of the cranial cavity, and the mesencephal does not present any marked furrow between paired optic lobes. Of the resemblances from which Huxley concludes that, "in its cerebral [encephalic] characters, *Ceratodus* occupies a central place in the class Pisces" [Ichthyopsida, excluding Amphibia], some are trivial, others apply to more than one group, and others are founded upon errors of observation or interpretation. So far as the brain is concerned, *Ceratodus* has no near affinity with the Plagiostomes, much less with the Holocephals, Ganoids, Teleosts or Marsipobranchs. In the writer's opinion, the Dipnoi form a class coordinate with the Amphibia, with which, on the whole, they are most nearly allied. The heart needs further study, and the development is unknown.

In a shark, *Scymnus*, as figured by T. J. Parker (*New Zealand Inst. Trans.*, xv. 1882; *Nature*, December 30, 1886), each lateral portion of the prosencephal, between the unpaired part and the olfactory lobe, presents a fusiform and nearly symmetrical dilatation. In 1876 the writer called attention (*Am. Jour. Sci.*, xii. 105) to the fact that in the lamprey the only part which can be regarded as a cerebral hemisphere lies *laterad* of the olfactory lobe (caudad when the paired portions are at a right angle with the meson); also that in most sharks and rays the "hemisphere" projects on the *opposite side* of the olfactory crus, and usually unites with its platetrope (lateral homologue). In Dipnoi the cerebral outgrowth is *ventral*. In either of these directions in which what may be regarded as the special organ of the mind is projected among these low or generalized forms there would seem to be mechanical obstacles to any considerable expansion; but *dorsally* there is opportunity for comparatively unlimited extension, and it is in this direction that the hemispheres begin to develop in the Amphibia and attain such enormous growth in Birds and Mammals. This revolution, so to speak, of the hemisphere about the olfactory axis accords with other considerations which have led Spitzka and the writer independently to consider the prevailing idea that the olfactory lobes are mere appendages of the cerebrum as nearly the reverse of the truth.

EXPLANATION OF FIGURES.

The figures are tracings from photographs, with slight modifications. The proportions and leading features are therefore accurate. There are some points of difference between the two brains, and some conditions which may be artificial; these will be referred to in connection with the several figures. Attention is called to the fact that, to one familiar with the brains of Amphibia, Reptiles, and the lower Mammals, the cephalic portion (prosencephal) of the *Ceratodus* brain looks more natural when held upside-down; this is due to the unusual relative positions of the olfactory tract and the cerebral hemisphere.

The following apply to the three figures: The dotted areas represent cut or artificial surfaces; the heavy line, forming the ental margin of the cut surfaces, represents the *endyma*, which lines the cavities and is reflected over the plexes. The line (usually lighter) which forms the ectal margin of the cut surfaces, and the outline of parts not cut, represents the *pia*, from which vessels are given off to form the plexes. At some places—*e.g.*, the *metaplex*, or membranous roof of the *metacœle*, and the dorso-caudal wall of the saccular *conarium*—the parietes consist only, or practically only, of the pia and the endyma; at other places—*e.g.*, the greater part of the *infundibulum*—the nervous constituent of the parietes is very thin. Along the roof of the *mesocœle* and the floor of the same region and the parts caudad

of it the double outline indicates the existence of a peculiar, thick, almost cartilaginous, and apparently non-vascular envelope, the nature and relations of which are undetermined. No attempt has been made to show the *arachnoid*. From what has been said it will be understood that the clear areas enclosed by the endyma represent the *encephalocœle*, or cavity of the brain, with its extensions into the *conarium* and *hypophysis*, while the clear areas not so included represent natural, pial surfaces. The *metacœle* and *epicœle* together correspond to what is commonly called "fourth ventricle;" the *mesocœle* to the iter, or cavity of the region of the optic lobes; the *diacœle* to the larger part of the "third ventricle;" the *aula*, which is commonly confounded with the third ventricle, is really the mesal division of the *prosocœle*, or irregular cavity of the prosencephal; its other divisions are the *procœle* ("lateral ventricle") and *rhinocœle* ("olfactory ventricle") on each side.

FIG. 1.

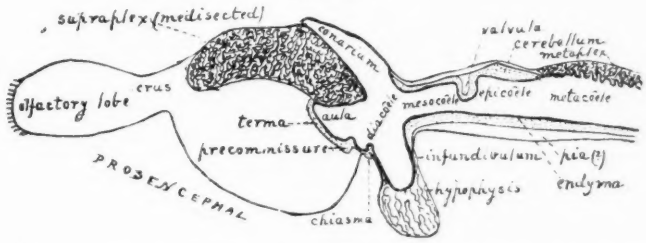


FIG. 1.—Medisection of the brain of No. 425 (× 2). The natural (pial) surfaces are those of the mesal aspect of the olfactory lobe and crus and of the larger part of the "cerebral hemisphere." The supraplex in this specimen is very thick, completely hiding the *prerima*, through which it finds entrance into the procœles, as seen in Fig. 2.

FIG. 2.

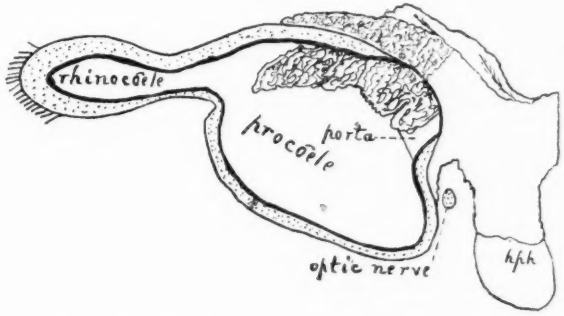
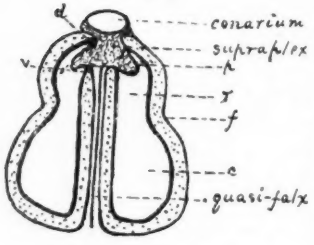


FIG. 2.—Part of the same brain (× 2), the left prosocœle exposed so as to show the extent of the plexus after its entrance. The area marked *porta* is the lateral orifice of the aula, and is more commonly called "foramen of Monro;" *hph* indicates the hypophysis.

FIG. 3.—Transection of No. 424, just cephalad of the conarium (× 3). In this the plexus is not so thick in the dorso-ventral direction, but its prolongations (covered, like all plexes, by endyma) are bulky, and cause the dorsal and ventral margins of the rima (*d*, *v*) to be far apart. Between the mesal surfaces of the lobes is a line representing the membranous but tough *falx*, the exact relations of which to the plexus are not determined; *e* points to the ventral or true cerebral portion of the procœle; *r* to its dorsal part, which is more directly continuous with the cavity of the olfactory lobe. The lateral furrow (*f*) may be significant, but may also be the result of alcoholic shrinkage. It does not appear in No. 425.

FIG. 3.



TERIAS LISA.

(At Ship Island, Gulf of Mexico.)

FRAIL habitant of yonder shore,
From off the leaf that sheltered thee
What wondrous craft thy being bore
Safe through the cyclone of the sea!
Thy citron-yellow wings are bright,
And soft the rosy fringe they wear,
And rays of gloom and silver bright
Adorn thee, blossom of the air!

The Cassia, on whose silken flower
Thy fragile life its being fills,
What hast thou garnered of its dower
To waft thee where thy spirit wills?
What dream of flowers of fairer hues,
Of lights more beautiful than dawn,
Of winds of balm and honey-dews
Allured thee ever on and on?

Thou didst but ask, O faëry sprite,
A blossom cup, the morning beam,
Companions for thy circling flight,
And love to share thy rainbow dream!

Here on the white, sea-drifted shore
Thy feeble, fluttering life I scan;
Thou tellest the lesson o'er and o'er,—
Thou art the history of man.

Laura F. Hinsdale.

BILOXI, MISSISSIPPI.

EDITORS' TABLE.

EDITORS: E. D. COPE AND J. S. KINGSLEY.

WHY does not some master-mind arise and give us a complete work upon unnatural history? Such a treatise is a great desideratum, for its publication would be a great boon to the scientific world. Were there such a work in existence no doubt Congress could be induced to make a liberal appropriation and furnish copies gratis to all who should apply for them. The saving this would afford to publishers and the relief it would vouchsafe to readers and editors would be inestimable, for then that innumerable throng longing to get their names and their lucubrations in print would have no excuse for existence; all their "discoveries" would be forestalled. No more would audiences be bored with fanciful theories of the way in which the ancient Egyptians carved all the Pyramids out of solid rock; nor would editors be compelled to wade through manuscripts proving "incontestably" that albinos were always the result of fright in the pregnant mother, because albinos are most abundant in rabbits, and every one knows that rabbits are the most timid animals in the whole world.—*Q. E. D.*

As was intimated in the opening sentences, a complete unnatural history requires a master-mind and abilities of no common order. There are, it is true, many works which fall but little short of perfection in this line; but, still, a careful search reveals lapses which ruin them as complete encyclopædias of misinformation. Usually the failure arises from the fact that the author is utterly unconscious of the nature of the treatise he is producing. He works in sober earnest, thinking to surprise the whole world; and he would do so were it not that in an evil hour he allows a few really credible facts to creep in. The qualifications necessary are an instinctive ability, not to be ac-

quired by any education, to discriminate between the false and the true, always appropriating the former and rejecting the latter, a love of the marvellous, and a power to quickly assimilate the erroneous. The work must, of necessity, be largely a compilation, for an intellect capable of producing the work would be lacking in the imaginative side, and could not possibly evolve it in its entirety from its inner consciousness. It must be able to trace results from no adequate cause. The syllogism must be ignored. There must be a realization of the magnitude of small things, and a capacity to tear a given statement from its surroundings and set it forth in all its nakedness, without regard to the incongruity of its new position. To all these points must be added a proper modicum of self-esteem, a conviction that all the so-called leaders of science are totally wrong, and that the author alone is infallible.

Such a man as we have drawn would produce a perfect work; but where shall he be found? Several times we have thought ourselves on the right track. We have turned over page after page fully persuaded that the desired work was before us, or, at least, that the author was capable of producing it; but, alas! it is like the American epic, it has yet to be written. The man who described six new genera and thirteen new species of thunder and lightning gave promise, but, unfortunately, he is dead. Who of the living will rise and fill the gap time can only decide. The prize offered for the successful work is a large one,—Immortality, along with Pedro Carolino, the author of "English as she is Spoke." The candidates are many, but, so far, all have shown lucid intervals, or have evinced a disinclination for the task, and have turned to less laborious fields just as they had aroused a hope that here was at last the long-looked-for wonder. When he comes he will receive an ovation from the world of science, which is tired of being told that clams travel on the bottom of water-areas by means of suction through their open shells; that the hippopotamus was designed to dredge out the channels of tropical rivers; that the strongylus is a parasitical action of the intestines; that the bill of the woodpecker has a force of bill proportionately to a twenty-ton trip-hammer; that the Mound-builders used the British inch in laying out their earth-works; that the Anglo-Saxons are the ten lost tribes of Israel; that the alligators originated in a cold climate because

they hibernate in a warm one; that the flesh of the sponge is washed off merely by being drawn from the water; that the nettle-cells of the hydroids are shot out with inconceivable velocity to lasso the prey; that—but we forbear. We only hope and pray for a relief, or even a respite, from the continual shower of unnatural history which is being poured out upon a long-suffering world of science.

On a former occasion we referred to the gross injustice which has been perpetrated by the State of Michigan in the matter of its late geologist, Professor Rominger. This gentleman, by economical methods, saved enough of his small appropriation to pay for the publication of his report. When the report was completed the State refused to publish it and retained the surplus in the treasury, where Professor Rominger had, with too great faith, allowed it to remain. The State should either publish the report or return the money to Professor Rominger. Michigan cannot afford a transaction like this to stain her history, and, in view of her general intelligence and liberality to learning, it is surprising that the injustice has not been corrected long ago.

We understand that the fine exhibition of basaltic columns at Llewellyn Park, Orange, N. J., is undergoing destruction. It is being used as a quarry for paving and macadamizing material. This is to be greatly regretted, and we hope that the persons controlling the park will endeavor to put an end to the desecration. It is one of the principal attractions to visitors and residents in the neighborhood, and the authorities of the park will do well to see that it is preserved.

RECENT LITERATURE.

Trouessart's Microbes, Ferments, and Moulds.[1]—This work is intended for the general reader, and not for the specialist in science. In the words of the author, "There is much to be done before modern society is practically on a level with the achievements of science; many prejudices must be uprooted, and many false notions must be replaced by those which are sounder and

[1] The International Scientific Series. Microbes, Ferments, and Moulds. By E. L. Trouessart. With one hundred and seven illustrations. New York, D. Appleton & Company, 1886. 12mo, pp. xii. 314.

more just." This is the laudable task the author sets before himself.

The general plan of the book may be understood from an enumeration of the headings of the several chapters, as follows: Parasitic Fungi and Moulds; Ferments and Artificial Fermentations; Microbes or Bacteria; Microbes of the Diseases of Domestic Animals; Microbes of Human Diseases; Protection against Microbes; Laboratory Research, and Culture of Microbes; Polymorphism of Microbes; The Microbian Theory compared with other Theories set forth to explain the Origin of Contagious Diseases.

In turning over these chapters, so admirably planned to accomplish the author's purpose, one is pained to note the evident want of acquaintance of the author with his subject. A book of this kind should have been intrusted to a specialist, who could have done something to popularize the difficult subject, and not to one who has no specialty, unless it be that of dabbling in everything, "palæontology, bibliography, zoology, general biology, geographical distribution, vertebrates, mammals, ornithology."[1] The result is a book which is so full of errors of interpretation as to greatly lessen its value.

It is difficult to criticise a book like this in detail, and it is perhaps needless, as no ordinary revision could eliminate its faults. Nothing less than a rewriting of most of the chapters would make the book what it should be. A few examples, however, will serve to show the kind of work done by the author. On page 11, we are told that in the mushroom "the part which we eat and call the umbrella represents the flower or floral peduncle of other plants." Fig. 18, which is intended to illustrate *Peronospora infestans*, is not that species at all, but evidently the one on the grape. Fig. 23 is printed upside down. On page 128 occurs a most marvellous jumble; an attempt is there made to discuss the cause of the red color which occasionally appear on ponds, and which is common on the snow in northern regions, and, astonishing as it may seem, Protococcus is regarded as a microbe!

It would be unfair to leave the impression that this book has no value whatever. It may prove to be to some mind the suggestion from which will eventually spring the desire to know more about the "infinitely little" things. Should it do so we should not condemn it too severely, although we might still wish that it had been more carefully prepared.—*Charles E. Bessey.*

Economic Fungology.[2]—Little attention has been given in

[1] See International Scientists' Directory, 1883.

[2] An Elementary Text-book of British Fungi. Illustrated by William Delisle Hay, F.R.G.S., author of "Brighter Britain," etc., etc. London, Swan, Sonnenschein, Lowry & Co., Paternoster Square, 1887.

this country, and little more in England, even, to the study of the fungi from an economic, or more properly a culinary, stand-point. Dr. M. A. Curtis, of North Carolina, was reputed to be an expert in distinguishing the edible from the inedible species, but scarcely anything now remains to us of his work, for he published little upon this branch of botany. In England, Badham's "Esculent Funguses," published many years ago, has served in a way to give to the beginner in Economic Fungology little more than a start. Its good plates have always made it valuable.

A late work, with the too ambitious title of "An Elementary Text-Book of British Fungi," by W. D. Hay, is intended to supply the need of a book for the beginner or amateur who wishes to be able to pick out the edible fungi from the host of inedible ones. While the book is by no means such a one as its title would indicate, it *is* fairly successful as an attempt "to collect information relating to such fungi as have an economic value, either as esculents or poisons." The author is not a botanist, and has the honesty to admit that "It has never been my privilege, as yet, to meet with any person versed in mycology from whom I could derive instruction." His practical acquaintance with the larger fungi may be inferred from this sentence from the preface: "But, so far as 'toad-stool eating' goes, I believe I have a right to speak with authority, since my own gastronomic experiments have been many, frequent, and varied."

Of the classification used in the arrangement the less said the better. It is simply atrocious. But let not the botanist toss aside the book as useless on that account. He will find much valuable information in it which he cannot obtain elsewhere. The descriptions are good, and given as they are in popular terms, the tyro will find the task of recognizing the species much simplified. Little can be said in commendation of the choice of English names for the species, and occasionally the English name is as difficult to remember as the scientific one,—*e.g.*, Fork-gilled Green-cap (*Russala furcata*); Infamous Clitocybe (*Agaricus inversus*); Orange Jelly-sprout (*Tremella mesenterica*); Oyster of the Woods (*Agaricus ostreatus*), etc. On the other hand there are some good selections of English names; among these are the following, viz.: Bolet (species of Boletus), Polypore (species of Polyporus), Lactar (species of Lactarius), Ink-cap (species of Coprinus).

A valuable feature of the book is found in the appendix, which is devoted to the preparation of fungi for the table. Here the ambitious cook may obtain many suggestions as to the preparation of appetizing dishes from many a common fungus, with the French name thrown in. Thus we have recipes for Pratelles à la Bourgeoise, Pratelles à la Provençale, Bolets à la Citoyenne, Oaktongue à l'Américaine, Puffball à la Lyonnaise, Puffball à la Grande Duchesse, etc.

The plates, of which there are sixty-nine, consist of the woodcuts of Cooke's "Handbook" arranged upon the pages. Not more than a dozen or so of these plates have any connection with the text, and they are consequently of no sort of value. Evidently the publisher had these on hand, and put them in to fill up. They add thickness to the book, and doubtless add also to its cost.—*Charles E. Bessey.*

Colton's Elementary Course of Practical Zoology.[1]—This work is truly an elementary one,—not a text-book, but a series of guides to the study of certain typical animals, with the aim of giving the student, by following the directions given, such a practical acquaintance with comparative anatomy as will enable him to obtain a clear idea of the animal kingdom. Classification of the objects chosen is not attempted, for the much alike grasshopper and cricket commence the work, and are followed by examples of the other hexapod orders. Then come studies of the spider, millipede, and various Crustacea, to which succeed the earth-worm, clam, and snail. The Infusoria and Amœba come after these, and then the author proceeds to the fish, the frog, the snake, the turtle, and the mammal, which are succeeded by the echinoderms, cœlenterates, and sponges. This arrangement seems to have been carefully considered in the adaptation of the work to the needs of those who will most use it,—students in academies and high schools,—and here this has a marked advantage over those laboratory manuals which follow a cut-and-dried system. By first examining closely-allied forms they are led to comparative work, while the order of the subjects is such as to accommodate the increasing skill of the pupil in manipulation. The work is really a valuable one for beginners in zoology, and deserves the success with which we understand it is meeting.

Lydekker's Catalogue of Fossil Mammalia.[2]—Mr. Richard Lydekker, formerly of India, has recently followed up his extensive series of papers upon the fossil fauna of Hindustan by a valuable catalogue of the Fossil Mammalia of the British Museum of Natural History. The portion of the catalogue issued comprises four volumes of the usual size of the British Museum series, with rather more than one thousand pages and one hundred and thirty-four illustrations. Part I. contains the Primates, Chiroptera, Insectivora, Carnivora, and Rodentia. Part II. the Ungulata Artiodactyla. Part III. the Ungulata Perissodactyla, Toxodontia, Condylarthra, and Amblypoda, while Part IV. is entirely occupied by the Proboscidea. The classification is based

[1] An Elementary Course in Practical Zoology. By Buel P. Colton. Boston, D. C. Heath & Co., 1886.

[2] Catalogue of the Fossil Mammalia in the British Museum (Natural History). Part I. By Richard Lydekker, B.A.F.G.S., etc. London, 8vo. 1885. Printed by order of the Trustees Brit. Mus.

upon that adopted by Professor Flower, but is modified to make it include the host of extinct forms here dealt with. In his preface the author avows himself one of that school of naturalists who use generic terms in a wider sense. The Pikermi and Mont Leberon beds are classed as Pliocene, the Eppelsheim beds as uppermost Miocene; the Ronzon and Hempstead (Isle of Wight) beds as lowest Miocene (the latter with a query); the Quercy phosphorites form the top of the Eocene, while the Egerkingen beds of Switzerland are placed at the bottom of the Upper Eocene. Among the peculiarities of classification is the inclusion of the dogs as a subfamily (Caninæ) of the Ursidæ. The Proboscidea include three species of Dinotherium, twenty-six of Mastodon, and eighteen of Elephas.

Report of the U. S. Commissioner of Fish and Fisheries, 1883.—This report contains twelve hundred pages of valuable matter and numerous illustrations, among which may be especially mentioned the eleven plates of Cetaceans, which illustrate Mr. True's suggestions to lighthouse-keepers and others relative to collecting examples of these animals. The report proper occupies only ninety-five pages, including a statement of the results of the inquiry into the history and statistics of food-fishes and an account of the progress of pisciculture. In the appendices we find papers by Stone, Tanner, Smiley, Duff, Day, Ljungman, Lundberg, Verrill, Bush, Eisen, Shufeldt, Seal, Mather, Benecke, etc. The most voluminous appendix is that relating to natural history and biological research. Nearly two hundred pages of this are occupied by Professor Verrill's account of the results of the explorations made by the "Albatross" in 1883. Lieutenant Tanner devotes a still larger space in Appendix A to the construction and outfit of the "Albatross," and a report upon the work done during the cruise of 1883. The "Albatross" reports are profusely illustrated.

Gustav Eisen's "Oligochætological Researches" and Dr. Shufeldt's "Osteology of *Amia calva*" are valuable special papers.

Biographical Memoirs of the National Academy of Science, Vol. II.—This volume contains fifteen biographies of deceased members of the National Academy, including the well-known names of Louis Agassiz, Jeffries Wyman, J. P. Kirtland, J. L. Le Conte, A. Guyot, and J. W. Draper.

RECENT BOOKS AND PAMPHLETS.

Maiden, J. H.—Report of the Australian Museum. N. S. W., 1885.

Nehring.—Ueber die Abstammung unserer Hausthiere, mit besonderer Berücksichtigung von Hund, Schwein und Pferd. March, 1885.—Ueber einen in die Gefangenschaft gezüchteten täckel-beinigen Hasen. SB. Ges. Nat. Freunde. Berlin, 1886. Both from the author.

Hunt, T. S.—A New Basis for Chemistry, a Chemical Philosophy. Boston, S. E. Cassino, 1887. From the author.

Lydekker, R.—The Fossil Vertebrata of India. Ext. Records Geological Survey of India, vol. xx. From the author.

Boulenger, G. A.—On two European Species of Bombinator.—On the South African Tortoises allied to Testudo.—Remarks on Prof. W. K. Parker's paper on the Skull of the Chameleon. All from Proc. Zool. Soc. London, 1886.

Boulenger, G. A.—Catalogue of the Lizards in the British Museum, vol. iii., 1887. From the trustees Brit. Mus.

Boulenger, G. A.—A Synopsis of the Reptiles and Batrachians of Rio Grande do Sul, Brazil.

Jenkins, O. P.—List of Fishes collected in Vigo County, Ill., in 1885 and 1886. Ext. The Hoosier Naturalist. From the author.

Adams, H. B.—The College of William and Mary. Circulars of Information of the Bureau of Education. No. 1, 1887.

Stowell, T. B.—Natural History in Secondary Schools. From the author.

Homes, G. B.—On Some Abnormalities of the Frog's Vertebral Column. *R. temporaria.* Ext. Anatomischer Anzeiger, 1886. From the author.

Allen, J. A.—The West Indian Seal. *Monachus tropicalis.*—Note on Squalodont Remains from Charleston, S. C.

Cope, E. D.—Synopsis of the Batrachia and Reptilia obtained by H. H. Smith, Matto Grosso, Brazil. Amer. Philos. Soc., March 13, 1887.—On the Structure and Affinities of the Amphiumidæ. Amer. Philos. Soc., 1886.

Sargent, F. L.—Guide to the Recognition of the Principal Orders of Cryptogams. Cambridge, C. W. Sever, 1886. From the publisher.

Parker, W. K.—On the Morphology of Birds. Ext. Proc. Roy. Soc., vol. xlii., 1887. From the author.

Mendenhall, T. C.—Characteristic Curves of Composition. 1887. From the author.

Ryder, J. A.—On the Origin of Heterocercy and the Evolution of the Fins and Fin-Rays of Fishes. Washington, 1884. Ext. Ann. Rep. Fish and Fisheries. From the author.

Giard, A.—La Castration Parasitaire. Ext. du Bull. Scien. du Dép. du Nord. 1887. From the author.

Walcott, C. D.—Cambrian Age of the Roofing-Slates of Granville, Washington County, N. Y.—Second Contribution to the Studies on the Cambrian Faunas of North America. U. S. Geol. Surv. From the author.

Call, R. E.—Description of a New Strepomatid.—Description of a New Rissoid.—Notes on the Land Mollusca of Kansas. Bull. Washburn Coll. Lab., 1886. From the author.

Hay, R.—Natural Gas in Eastern Kansas. From the author.

Bayley, W. S.—A Summary of Progress in Mineralogy and Petrography. From the author.

Mills, T. W.—Uric Acid. Medical News, 1885.—Notes on the Urine of the Tortoise. Both from the author.

Crosby, W. O. } On the Great Dikes at Paradise, near Newport. Ext. Proc. Bost.
Barton, G. H. } Soc. Nat. Hist. 1886. From the authors.

Parker, T. J.—On the Blood-Vessels of *Mustelus antarcticus.* Ext. Philos. Trans. Roy. Soc., 1886. From the author.

Wiedersheim, R.—Der Bau des Menschen, als Zeugniss für seine Vergangenheit. Freiburg, 1887.—Lehrbuch der Vergleichenden Anatomie der Wirbelthiere. Jena, 1886. From the author.

Stevenson, J. J.—The Faults of Southwest Virginia. Ext. Amer. Jour. of Science, vol. xxxiii.

Dawson, G. M.—Note on the Occurrence of Jade in British Columbia. Ext. Ca-

nadian Record of Science.—On the Fossil Plants of the Laramie of Canada. Trans. Roy. Soc. Canada, 1886. Both from the author.

Powell, E. P.—Does Science demonstrate the Existence of a Supreme Being?—Religious Fables.—Our Heredity from God.—Sin; a Crime against Life.—Character.—The Evolution of the Church.—A Good Conscience.—The Two Theologies.—Sinning against the Holy Spirit. All from the author.

Schlosser, M.—Palãontologische Notizen. Ueber das Verhältniss der Cope'schen Creodonta zu den übrigen Fleischfressern. From the author.

Purón, J. G.—Libro Primero de Zoologia. Appleton & Co., 1886. From the author.

Frear, W.—Composition of Soiling Rye.—Composition and Food-Value of Desiccated Apple-Pomace. Bull. Penna. State Coll. Agric. From the author.

Clarke, Hopewell, et al.—The Source of the Mississippi. 1886. Rep. from Science.

McMurrich, J. P.—A Contribution to the Embryology of the Prosobranch Gasteropods. Stud. Biol. Lab. Johns Hopkins Univ.

Spencer, W. B.—On the Presence and Structure of the Pineal Eye in Lacertilia. Rep. Quart. Journ. Micros. Sci. From Professor Moseley.

Swan, R. J., et al.—Fifth Annual Report of the Board of Control of the New York Agricultural Experiment Station. 1886.

Bateson, W.—On the Morphology of the Enteropneusta.—On the Ancestry of the Chordata. Studies from the Morphol. Lab. Univ. Cambridge. 1886. From the Balfour Library.

Johnson, Alice.—On the Fate of the Blastopore in the Newt.—On the Development of the Newt. Stud. Morph. Lab. Univ. Camb. 1886.

Weldon, W. F. R.—On the Suprarenal Bodies.—On *Dinophilus gigas.*

Heathcote, F. G.—On a Peculiar Sense-Organ in *Scutigera coleoptrata.*—The Early Development of *Julus terrestris.*

Amer. Assoc. Adv. Science.—Proceedings of the American Association for the Advancement of Science. Thirty-fifth meeting, 1886. Buffalo, N. Y.

Andreæ, A.—Die Oligocänschichten im Elsass. Strassburg. From the author.

Scribner, F. L.—Report on the Fungus Diseases of the Grape-Vine. 1886. From the author.

True, F. W.—A New Study of the Genus Dipodomys. Proc. U. S. National Museum, 1885. From the author.

Meyer, O.—Beitrag zur Kenntniss der Fauna des Alttertiärs von Mississippi und Alabama. From the author.

Whitfield, R. P.—Notice on Geological Investigations along the Eastern Shore of Lake Champlain.—Notice of a New Fossil Body, probably a Sponge related to Dictyophyton. Bull. Amer. Museum Nat. Hist., 1886.

Pilsbry, H. A.—Description of a New Hydrobia. From the author.

Atkinson, G. F.—A Family of Young Trap-Door Spiders. Entomologica Americana, 1886.—A New Trap-Door Spider. Amer. Nat., 1886.—Descriptions of some New Trap-Door Spiders, their Nests and Food. All from the author.

Trouessart, M.—Sur la Présence du Genre de Sarcoptides psoriques Chorioptes ou Symbiotes chez les Oiseaux. From the author.

Davidson, T.—A Monograph of Recent Brachiopoda. Trans. Linn. Soc. London, 1886. From the author.

Whiteaves, J. F.—Illustrations of the Fossil Fishes of the Devonian Rocks of Canada. Trans. Roy. Soc. Canada, 1886.

Boehm, G.—Die Gattungen Pachymegalodon und Durga. From the author.

Fish Commission, U. S. A.—Report of the Commissioner for 1884, with special scientific reports by J. W. Fewkes, J. A. Ryder, Chittenden & Cummins, O. Hermes, and C. Kerbert.

Credner, H.—Die Stegocephalen. VI. Theil. From the author.

Ward, L. F.—Broadening the Way to Success.—Moral and Material Progress Contrasted.

Russell, I. C.—Geological History of Lake Lahontan. Monographs U. S. Geol. Survey, vol. xl. From the Department.

Wright, R. Ramsay.—Biology in Medical Education. Ext. Canadian Practitioner, 1887. From the author.

Marsh, C. D.—Outline of Laboratory Work in Zoology. No date. From the author.

Thompson, E. H.—Archæological Research in Yucatan. Ext. Proc. Am. Antiqua. Socy., 1886. From the author.

Shufeldt, R. W.—The Camera and Field Ornithology. Ext. The Auk, 1887. —The Veterinary Service of the United States Army. Ext. Jour. Comp. Med. and Surg., 1887. From the author.

Haddon, A. C.—Suggestions respecting the Epiblastic Origin of the Segmental Duct. Ext. Proc. Roy. Dublin Socy., 1887.

Lockwood, Samuel.—Raising Diatoms in the Laboratory. Ext. Jour. N. Y. Micros. Socy., 1886. From the author.

GENERAL NOTES.

GEOGRAPHY AND TRAVELS.[1]

Miscellaneous.—Major-General Tillo has calculated, from the most reliable data, the lengths of various rivers, and gives the following as the eight longest: (1) Missouri-Mississippi, 4194 miles; (2) Nile, 4020; (3) Yang-tsze-kiang, 3158; (4) Amazon, 3063; (5) Yenisei-Selenga, 2950; (6) Amur, 2920; (7) Congo, 2883; (8) Mackenzie, 2868. The map of Humphreys & Abbot is the authority for the Missouri-Mississippi, which Klöders gives as 3658 miles.

American Notes.—Governor Fontana, of Chubut, has recently explored the Chubut and its tributary, the Charmate, passing through the Andes by a very low pass, since the confluence of the two mentioned rivers is only eighteen hundred feet above sea-level, and at sixteen hundred feet above the sea the valley of the Cercorado, a river flowing into the Pacific, was reached. On their return the party found a large lake, through which the river Senguel flows. The Welsh colony on the Lower Chubut will probably colonize on this lake.

Don Jose Santelices has ascended Licancaur, a volcano on the eastern boundary-line of the Chilian province of Antofogasta. Tambos—houses of a single room, with a low, stone bench—are found on the Inca road which leads to the summit. The crater was found to have a bottom thirteen hundred feet in diameter, with a pond four hundred feet by three hundred and fifty feet in its centre. On its banks there are remains of some thirty large stone houses built by the Indians, and a large quantity of fuel

[1] Edited by W. N. Lockington, Philadelphia.

was found there,—whether carried there by the Peruvians or by the Calchaquis, who opposed them, is not certain.

AFRICAN NOTES.—The Wagenia, or Wenga, who live near Stanley Falls, are stated by O. Baumann, of Dr. Jenz's Expedition, to be on friendly terms with Tippoo Tib, and thus far to have not been demoralized by the influence of the Arabs.

Stanley reached Bansa-Manteka, below Stanley Pool, before March 29. He intends to ascend the Mburu, which is now known to be navigable for some distance. From the head of navigation he will strike across country to the Albert Nyanza at Murswur, where he will form a fortified camp, and whence he will send boats to inform Emin Bey of his arrival. It appears that the intercourse on both banks of the Kongo above Stanley Pool is interrupted by the attacks of the natives upon the caravans.

Tippoo Tib has discovered a tribe of people whose money consists of copper spears. These people make highly-artistic metal-work, and manufacture enormous spear-heads of very thin copper, which are passed from hand to hand like bank-notes. In the purchase of ivory one is worth two hundred pounds. Everything among them has its value reckoned in terms of spears.

Lieutenant Baert has recently ascended the Mongalla, a northern tributary of the Congo considerably to the east of the Mobangi, as far as the limit of navigation, and to a distance of two hundred miles from its mouth. The river flows in a general southward direction through a well-wooded country, and the rapids, which stayed farther ascent, occur in about 3° 30′ N. latitude and 22° E. longitude. As this is north of the latitude reached upon the Welle by Dr. Junker, it looks as though the latter river must certainly be cut off from joining the Mobangi.

It is evidently premature to suppose that the Welle is identical with the Mobangi, although Dr. Junker followed its course to 22° 47′ 40″ E. and 3° 13′ 10″ N. latitude. Its level is not accurately known, and it may turn into the Congo by some other course, or even find its way to Lake Tchad.

Four months later than the advices brought by Dr. Junker, Emin Pasha, accompanied by Dr. Vita Hassan, ten Egyptian officers, three Greeks, and four negroes, visited the capital of Unyoro, and sent a message to Mwanga, king of Uganda, requesting an audience. This was granted to Emin, Hassan, and the three Greeks only, but permission to pass through Uganda to Zanzibar was refused.

It is quite evident that the Arabs are masters of the Upper Congo, and Tippoo Tib's appointment as Governor of Stanley Falls Station is virtually a surrender of that part of the river into their hands.

Lieutenant Wissmann has been exploring in the land of the

Baluba and the basin of the Lubilash. He and De Macar, the commander at Luluaburg, visited the residence of Mona Tenda, near the Lukula. The people are Bashilange, and the country is densely populated. The eastern bank of the Lukula belongs to the Baluba, and forms an undulating prairie, which, though barren in appearance, has a numerous population. Wissmann intends to go north and explore the region where the Lulongo, Juapa, and Lomami have their sources.

The Rev. G. Grenfell, in a recent ascent of the Kwango in the "Peace," found a large tributary, the Juma, entering the river from the east, and bearing so great a quantity of water that it was doubtful which was the larger stream. He ascended the great bend of the Kwango, which at 4° 30′ south comes back to its northerly course. The Kikunji Falls, which stopped his ascent, are only about three feet high. Mr. Grenfell has since returned to England.

M. Grandidier and Mr. Sibree, in the *Antananarivo Magazine* (Christmas, 1886), point out that about thirty miles of canal would convert the channels and lagoons of the east side of Madagascar into an extensive internal water-way of great commercial value.

The "Bolletino" of the Italian Geographical Society publishes a detailed account of the Italian possessions on the Red Sea. Assab and the surrounding district is absolutely annexed, while Massowa, Emberemi, the Abd-el-Kader Peninsula, Gherar, the Taulud Island, and the Dahlak Archipelago are garrisoned and administered by Italy, and the coast from Annesley Bay to Assab is under Italian protection.

Dr. Colin contributes to the *Revue d'Anthropologie* a paper on the Malinkes of Bambouk, once a ruling race upon the Upper Niger, but now divided into numerous little states, and apparently without a religion, though they were once Mohammedan. Their territory is about six hundred kilometres long and from eighty to one hundred and fifty in width.

Don Manuel Iractier has paid two visits to the newly-acquired Spanish territory on the east coast of Africa. On his last journey (1884–85) he traversed four thousand miles between the equator and 3° N. latitude, penetrating from the seaboard to about 20° E. longitude, and surveying to their sources all the streams between the Rio del Campo and the Gaboon. Of these by far the largest is the Muni, which debouches in Corisco Bay, after receiving the waters of the Utamboni, Noya, and other affluents, and draining nearly six thousand square miles.

Major Serpa Pinto and Lieutenant Cardoso have arrived in Lisbon, after exploring the region between Mozambique and Lake Nyassa. The Lienda, a tributary of the Rovuma, was found not to rise in Lake Nmaramba, but to flow through that basin from Mount Songe, farther to the west.

ASIATIC NOTES.—Messrs. James, Younghusband, and Fulford have recently travelled from Mukden, the capital of South Mantchuria, up one of the tributaries of the Yalu, and through the main chain of mountains by a pass two thousand seven hundred feet high to the Chang Peishan, or ever-white mountain. This is a recently extinct volcano, with a clear lake in its crater. The loftiest of the peaks around this crater is seven thousand five hundred and twenty-five feet above the sea. The sides are composed of disintegrated pumice. This mountain is the centre of the river-system of Manchuria, since the rivers Yalu, Tumen, and Sungari all have their sources there. Descending the Sungari, the party went to Kirin, and thence to Tsitsihar, the capital of Northern Manchuria. Southeast of Tsitsihar they crossed a high and undulating steppe, with numerous brackish lakes, from the earth of the shores of which soda and salt are obtained.

M. Potanin left the Koko-Nor June 25, 1886, crossed the Gobi from south to north, and discovered four parallel mountain-ranges continuing the Altai chain to the southeast. That part of the Nan-Shan Mountains which separates the plains of Southern Mongolia from the region drained by the Hoang-ho is composed of three mountain-ranges, with passes twelve thousand eight hundred feet high and valleys ten thousand feet above the sea. On his way north he fell in with the before-unknown tribe of Jegurs. He surveyed the country passed over.

Sr. E. Modigliani has visited Nias, an island some thirty miles from the west coast of Sumatra. The natives are fierce savages, everywhere addicted to head-hunting, and the rajah of Bavolovalani had no idea of collecting skulls except from the living subject. Owing to local feuds the explorer did not go far into the interior; yet on a second visit contrived to bring away a large quantity of valuable material. The natives of Nias are evidently Malays; yet their crania look as though a Papuan skull were fastened to a Malay face. Their weapons are of iron, and they work iron, brass, and gold for themselves. They have axes, barbed lance-heads, and swords like the parangs of the Dyaks. Their shields are heavy and coated with buffalo-hide, and they make curious iron helmets. Their swords are sheathed in wood, and have a globular wicker or rotang basket in front. Every young man must have cut off one head,—no matter if of man, woman, or child.

MM. Bonvalot and Capus, the French travellers who have recently been turned back by the Emir of Afghanistan, write to the French Geographical Society that the country between Teheran and Meshed belongs to the steppe region of Central Asia by its fauna, flora, and geology. The journey between these places was, for most of the way, on the edge of an immense basin, the bottom of which is the Khevir, or great salt desert.

From the bridge of Saugil to the Thian Shan, from west to east, such a thing as a forest is not known.

Manipur is a valley surrounded by mountain-ranges which have a rain-fall as high as or higher than one hundred and twenty inches. The valley has but thirty-nine inches of rain-fall. The snow-line is low here. The whole valley, three thousand feet high, was covered with hoar-frost in December, and Sarameti, under thirteen thousand feet high, has, the natives say, snow all the year. Dr. G. Watt correlates the lowness of the snow-line with the immensity of the rain-fall, which in winter is a snow-fall. This great rain-fall accounts for the volume of water brought down by the Irawadi, while a river travelling for hundreds of miles in Thibet would pick up but a small quantity.

General J. T. Walker recently read before the Geographical Society of London a paper upon the Lu River of Thibet, the Lu Kiang or Lu-tse-Kiang of the Chinese. This river is generally held to be the source of the Salween, but General Walker adduces reasons for believing it to be that of the Irawadi.

Freiherr von Schleinitz has recently accomplished a survey of Huon Gulf, in German New Guinea, establishing the direction of the coast-line, and the position of the reefs and of eight hitherto unknown harbors. He has discovered nine new rivers. One of these, the Markham, has a broad valley extending far inwards between high mountain-ranges. The south coast of Huon Gulf consists of primitive and metamorphic rocks, with sedimentary rocks and volcanic formations. A further survey afterwards made of the coast, from Astrolabe Bay to the mouth of the Empress Augusta River, led to the discovery of a series of bays, harbors, islands, and rivers.

EUROPEAN NOTES.—*Spain.*—It is high time that some common errors regarding the condition of Spain were corrected. It is commonly believed that the country is unprogressive and the people semi-mediæval. This is far from being the case. Spain is advancing with a rapidity quite equal to that of other western European nations, but, as she started later, she is still behind. Her population, unlike that of France, is continuously on the increase, and, as there is still plenty of room in the country, it is likely to keep on increasing until, in a few decades, Spain will again claim her right to stand among the foremost nations of Europe. Most of the great central plain of Castille and Leon is capable of the closest cultivation, and probably received it in the days of Moorish occupation, for it is crossed by numerous mountain-ranges, which give rise to many rivers. The coast provinces and the Ebro Valley are capable of supporting an immense population, and do so in spots that are favored by the application of the necessary industry. There are at the present time twenty-two millions of people in Spain, whereas at the end of the reign

of Charles III. it is probable that the population barely reached eight millions. Some figures given by Sr. Costanzo Stella in the London *Times* show clearly the progress of the country. The agricultural population, which was but three million six hundred and fifteen thousand eighty-five years ago, is now nine million three hundred and twenty-eight thousand, and the area cultivated has increased from fifty-three million acres to one hundred and ninety-three million five hundred thousand. The head of cattle have doubled since the commencement of the century, and the industrial population has trebled. In 1860 exports and imports together were only twenty-five million eight hundred thousand pounds, whereas they are now fifty-six millions. The wine of Spain, which two decades ago could not be brought into the world's market, except from spots situated within easy distance by bullock-wagon of some port, can now be borne upon six thousand miles of railway, and the produce is reckoned at four hundred and sixty-one million two hundred and fifty-six gallons.

Prof. Miguel Marazta has discovered, in the valley of Rebas (Gerona, Spain), at the end of the Eastern Pyrenees, a race of dwarfs not more than four feet high. All have red hair, broad faces, strongly-developed jaws, flat noses, and rather oblique eyes. A few hairs take the place of a beard in the males, and the sexes are very much alike. The lips do not quite cover the large, projecting incisors. They live by themselves, intermarry, and have no chance of improvement. Are they the remnants of some old Mongoloid stock?

The last French census (May, 1886) shows an increase of only one per cent. per annum, and the last German census one of .71 per cent. per annum. In both cases this is a decrease in the rate, Germany, as well as France, having commenced to proportion its increase to the means of subsistence.

GEOLOGY AND PALÆONTOLOGY.

The Sea-Saurians of the Fox Hills Cretaceous.—The reptiles of the sea of the Fox Hills epoch possess considerable interest as being the last of their race; for the next epoch (the Laramie) saw, as is well known, the beginning of the lacustrine conditions which prevailed throughout the interior of North America, in one region or another, during the subsequent ages of Cænozoic time. The vertebrate fauna was more or less changed, especially so as regards the inhabitants of the waters. The most important modification of this kind with which we are acquainted is the extinction of the order Sauropterygia from the interior waters of North America. I have made some attempt to collect remains of these animals, but without any great success, for two reasons. One of these is the rarity of the specimens; the other is the disarticulated condition in which they are usually found.

Preliminary to a fuller account of the species, I give the following abstract of the results I have been able to obtain.

The Plesiosauridæ have been well divided by Seeley[1] by reference to the characters of the scapular arch and sternal region. Another criterion of difference is to be found in the form of the propodial bones. In the Polycotylinæ they are wider than long, and angular in form, resembling those of Ichthyosaurus. In the Plesiosaurinæ they are well-differentiated elements, as in Mosasaurus, or marine turtles. There are two genera of Polycotylinæ, both American, as follows:

Neurapophyses and all diapophyses and parapophyses coössified with vertebral centra	*Polycotylus.*
Neurapophyses and other processes articulating freely with centra	*Piptomerus.*

Of these, Piptomerus is represented by numerous remains in the Fox Hills beds of New Mexico. Other species occur, which present the following characters:

Neural arches loosely articulated	*Plesiosaurus.*
Neural arches coössified, parapophyses free	*Orophosaurus.*
Both neural arches and parapophyses coössified	*Uronautes.*

Of these genera, Uronautes has been previously obtained in the Fox Hills bed of Montana.[2] The probable character of the propodial bones refers it to the Plesiosaurinæ. These parts are unknown in the species referred to the two other genera named. Nor is it certainly known whether the structure of the shoulder-girdle is like that of Elasmosaurus or of Plesiosaurus; so that reference of a species to the last-named genus is provisional. The only possible duplication of names of the above genera is in the case of Orophosaurus, which might possibly be referable to Cimoliasaurus (Leidy); but if, as I believe, the individual described is adult, the two genera are quite distinguishable. The other characters of the genera and of the species are as follows:

Piptomerus Cope, g. n.—Cervical vertebræ short, slightly biconcave; dorsal vertebræ very short, nearly amphiplatyan; nutritive canals many, large. In the known species the articular surface is reflected on the sides of the centrum, so as to restrict the width of the dense layer. In the known species there is no nutritive foramen between the facets of the neur- and parapophysis in the cervical vertebræ. Free extremities of parapophyses thin-edged.

Piptomerus megaloporus, sp. nov.—Cervical centra wider than deep, longer than the dorsals, with a rather wide plane between fossæ of neur- and parapophysis. Two inferior foramina. Sutural surfaces of articular fossæ generally not roughened. Dorsal centra much compressed; neurapophysial fossa very oblique,

[1] Quarterly Journal Geological Society London, 1874, p. 436.
[2] Proceedings Academy Philada., 1876, p. 345.

with a large foramen below its external margin. Two or more small foramina on the inferior surface.

Diameters of a cervical vertebra,	anteroposterior	.0175
	vertical	.023
	transverse	.030
Diameters of a dorsal vertebra,	anteroposterior	.0125
	vertical	.029
	transverse	.027
Diameters of a propodial bone,	length	.019
	width	.043
	depth	.020

An abundant species in New Mexico.

Piptomerus microporus, sp. nov.—Dorsal vertebræ larger, and with a comparatively small nutritive foramen adjacent to the neurapophysis. Cervical vertebræ (if correctly identified) less robust than those of *P. megaloporus*, and with the neur- and parapophysial fossæ separated by a narrow plane-surface.

Diameters of cervical centrum,	anteroposterior	.016
	transverse	.035
	vertical	.0215
Diameters of dorsal centrum,	anteroposterior	.019
	transverse	.036

Two dorsal vertebræ certainly, and probably several others, and a cervical vertebra represent this species. New Mexico.

Piptomerus hexagonus, sp. nov.—Founded on a cervical vertebra, which is less robust than those of the other species, and which differs in having the neur- and parapophysial surfaces adjacent, and not separated by a plane-surface. The two inferior foramina are of very large size, and are well separated.

Diameters of cervical centrum,	anteroposterior	.013
	vertical	.024
	transverse	.031

Several similar but smaller vertebræ are contained in the collection. New Mexico.

Orophosaurus pauciporus, sp. nov.—Represented by parts of three cervical vertebræ, with large parapophysial fossæ looking downwards and outwards, which present a coarse sutural surface of the fundus. The basis of the entirely connate neurapophysis is compressed, and between it and the margin of the parapophysial fossa is an obtuse longitudinal angle. A very small nutritive foramen at the base of the neurapophyses. No other lateral foramina.

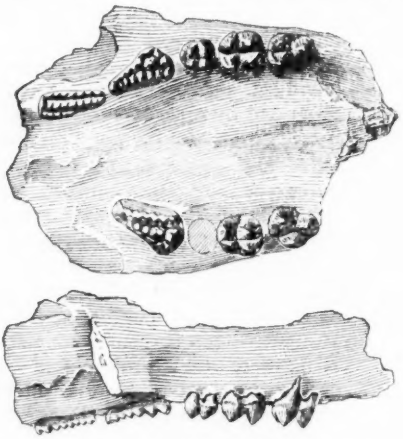
The vertebræ are more robust than those of Piptomerus, and are but little wider than deep. The articular surfaces are slightly concave medially and swollen at the circumference, where they are separated from the lateral surfaces by a shallow groove. Lateral surfaces with irregular, shallow, pore-like fossæ.

Diameters of articular face of cervical vertebra	anteroposterior	.034
	vertical	.040
	transverse	.046
Diameters of parapophysial fossa of same	vertical	.018
	transverse	.024

New Mexico.

In addition to these species, I have vertebræ of three other species of Plesiosauridæ from the Fox Hills bed of New Mexico, which are not sufficiently well preserved for description. One of these is nearly allied to the *Uronautes cetiformis* Cope, but is larger than the type. The other two may be provisionally referred to Plesiosaurus. Accompanying them are *Ischyrhiza antiqua* Leidy, Enchodus, sp., *Galeocerdo pristodontus* Ag., Otodus, sp., and other characteristic forms. The characters observed in the cervical vertebræ of the six species of Sauropterygia of the Fox Hills formation, confirm a hypothesis proposed by the writer in 1879.[1] This is that the necks of the species grew shorter with lapse of geological time, and as the sea shallowed. The long-necked forms are in America confined to older horizons of the cretaceous.—*E. D. Cope.*

The Marsupial Genus Chirox.—This genus was described by the writer in 1883,[2] from a few teeth of the upper jaw found



Chirox plicatus Cope, palate with dentition, viewed from below; ⅔ natural size.

in the Puerco formation of New Mexico. Since then a palate with the entire molar series of one side and nearly all that of

[1] American Naturalist, 1879, p. 131.
[2] Proceedings Amer. Philos. Soc., p. 321.

the other has been obtained. This shows that the teeth described are premolars, and that there are two true molars, which resemble those of Polymastodon and Neoplagiaulax. The premolars are a good deal like those of Plagiaulax, as described to me by Professor Osborn, and the question arises whether the dentition in question does not belong to Ptilodus. There are two reasons for answering this question in the negative. First, in Plagiaulax and Neoplagiaulax, according to Osborn and Lemoine, there is a tooth in the superior series resembling and opposing the peculiar-cutting fourth premolar of the inferior series; second, the only tooth which could oppose such an inferior premolar is the first molar, and this is not worn obliquely, as in Plagiaulacidæ, but transversely, as in Polymastodon. This and the second true molar support two and parts of a third longitudinal rows of cusps, which are, on the last tooth, worn by anteroposterior movement of an inferior tooth of corresponding form.

Chirox, then, is allied to the Polymastodontidæ, but differs from it in the possession of superior premolars. I therefore see in it the representative of a new family which I call the Chirogidæ. This family forms an interesting connecting type between the Plagiaulacidæ and the Polymastodontidæ. Chirox further differs from Polymastodon in having a second superior premolar of identical form with the first. It constitutes another indication of the Mesozoic character of the Puerco fauna.—*E. D. Cope.*

Geological News.—SILURIAN AND DEVONIAN.—H. A. Nicholson describes, in the *Annals and Magazine of Natural History*, some new and imperfectly-known Stromatoporidæ. Four of the species of Clathrodictyon occur in the Devonian and one in the Silurian of Canada.

M. Bureau has taken casts of some markings upon a muddy surface, and found that he had well-characterized Bilobites. Yet the markings were made by the tail of a shrimp in swimming.

MESOZOIC.—Mr. A. S. Woodward notes the undoubted presence of a columella in the skull of Ichthyosaurus, and figures the same (*P. Z. S.*, June, 1886). Professor Cope had first given a diagrammatic outline of the bone.

Mr. J. Carter, in a recent communication to the London Geological Society, adds fifteen or sixteen species to the fossil Decapoda of Great Britain. These occurred in the Oxford Clay at St. Ives. Only one had previously been recorded as British, seven were new to science, and nearly all are Macrura.

TERTIARY.—The fossil Mammalia of Maragha, in Northwestern Persia, include many species identical with those of Pikermi, Greece. The deposit was discovered thirty years ago, and the

beds, which are situated to the east of Lake Urumia, consist chiefly of reddish marls of fluvio-lacustrine origin. A Hipparion, probably identical with the Pikermi *H. gracile*, is the most abundant. *Giraffa attica*, *Palæoryx pallasi*, *Sus erymanthius*, *Mastodon pentelici*, and *Helladotherium duvernoyi* are among the remains, as is also the French *Felis brevirostris*.

The lower jaw of a Machærodus has been described from the "Forest-Bed" at Kessingland, Suffolk, England. The describer, Mr. J. Backhouse, stated his belief that hitherto no lower jaw of the genus had been found in England.

Mr. Lydekker has given to the Geological Society of London a list of the Cetacea of the Oxford Crag. These include Balæna (4 sp.), Megaptera (3 sp.), Balænoptera (4 sp.), Cetotherium (4 sp.), and *Herpetocetus scaldiensis*, together with nineteen species of Physeteridæ, one Squalodont, and three Delphinidæ. There are seven species of Mesoplodon.

Out of seventy-eight species or varieties of chilostomatous Bryozoa from a deposit in New Zealand, which was considered Miocene by Tenison-Woods, sixty-one are known living, and it would thus seem that too remote an age has been assigned to the deposit.

MINERALOGY AND PETROGRAPHY.[1]

Petrographical News.—The second[2] paper devoted to the study of the massive rocks belonging to the "Cortland series" on the Hudson River, near Peekskill, has recently appeared in the *American Journal of Science*.[3] In this paper the author, Dr. G. H. Williams, describes the norites and related rocks, which make up by far the greater part of the entire Cortlandt series. These norites are divided into norites proper, hornblende norites, mica norites, hyperites or augite norites, and pyroxenites. The norite proper is very rare, almost all sections showing the presence in small quantity of minerals which would, in accordance with a strict classification, require the rock to be placed in one of the other four groups. The most interesting facts brought out in the examination of these rocks are (1) the occurrence of orthoclase in several specimens, and (2) the existence of numerous inclusions in this orthoclase and in the more prevalent andesine. The orthoclase is in porphyritic crystals, in which are sometimes imbedded smaller crystals of plagioclase. Under the microscope the former is seen to possess a "shagreen" surface, due to numerous oval indentations. All the feldspar of the norites is filled with little inclusions of plates, rods, and dots. These seem not to be arranged in any definite position with regard to crystallographic

[1] Edited by Dr. W. S. BAYLEY, Madison, Wisconsin.
[2] *Cf.* American Naturalist, March, 1886, p. 275.
[3] Amer. Jour. Science, xxxiii., February, p. 135; March, p. 191.

planes, as demanded by Judd's shillerization theory, but are grouped in zones. They are regarded by Dr. Williams as original and representing the forms in which the iron first separated from the magma, this separation occurring contemporaneously with the crystallization of the feldspar. Many of the mica norites possess a well-marked schistose structure, a fact which led Professor Dana [1] to ascribe to them a metamorphic origin from sedimentary deposits. A study of their thin sections, however, shows this schistosity to be but another instance of the secondary development of this structure by pressure. The iron ore and emery deposits of this region were also examined. This ore is composed essentially of octahedral crystals of magnetite imbedded in a dark green mineral with the composition and optical characteristics of hercynite (or pleonaste, with a very low percentage of magnesium). This mineral is also found disseminated in small octahedral crystals in the rock adjoining the ore veins. Associated with the magnetite and hercynite of the ore occur also fibrolite and corundum.——The same author, in a communication in *Science*,[2] declares, as the result of microscopical examination, that the serpentine occurring at Syracuse, N. Y., must be regarded merely as an altered peridotite. The remains of bronzite crystals can still be detected in the rock, and consequently the view of Professor Sterry Hunt, that it must be looked upon as an altered sediment because of its intimate association with sedimentary beds of gypsum, can no longer be maintained.——In a preliminary "Note on the Volcanic and Associated Rocks of the Neighborhood of Nuneaton," England, T. H. Waller [3] mentions the occurrence there of ashes (tufa) composed of pieces of feldspar, a little quartz, and grains of some basic rock; a felsite with porphyritic crystals of quartz, in which lines of secondary fluid inclusions are well exhibited; a diabase porphyrite with augite twinned according to both twinning laws,—viz., parallel to oP and $\infty P\infty$; and, finally, indurated quartzites with the individual quartz grains enlarged by the addition of new quartz material whose optical orientation is identical with that of the original grains.——In connection with the statement of Dr. Williams in regard to the serpentine of Syracuse, it may be of interest to call attention to an article in which J. H. Collins [4] cites several examples to prove that "some beds of a common series have been changed into serpentine, while others (pass over) into hornblende schist." He thinks that many of the serpentines of Cornwall, which have heretofore been regarded as having originated by the alteration of intrusive sheets of picrite, may as well be considered as having originated in some other manner.

[1] Amer. Jour. Science, xx., 1880, p. 218.
[2] Science, March, 1887, p. 232.
[3] Geological Magazine, July, 1886, p. 322.
[4] Ib., August, 1886, p. 359.

Meteorites.—Very recently the name *giovanite* has been proposed by Meunier[1] for a brecciated[2] meteoric stone which fell at San Giovanni d'Asso, near Siène, in Italy, in 1794. Specimens of this same fall have been described previously, but the individual pieces were so small that the interesting facts which Meunier has discovered upon the examination of a larger specimen were overlooked. Meunier finds that this giovanite is made up of fragments of the rock limerickite cemented together by a substance with all the characteristics of leucite,—*i.e.*, the relations of these two substances are inversely what they are in *mesminite*, in which fragments of leucite are imbedded in limerickite. After briefly discussing the subject of the origin of this structure, Meunier concludes that there must be a community of origin for various meteoric rocks, and that in this common place of origin geological action (as we understand it) must exist. He further states that the analogy which it is sought to establish between meteors and comets (and shooting-stars) cannot be maintained.——Two meteors of considerable ethnological interest are described by Mr. G. F. Kunz[3] in the *American Journal of Science* for March. The first is a meteoric stone composed of rounded and angular pieces of olivine in a ground-mass consisting of iron. Analyses of the two constituents yielded Mr. Mackintosh the following figures:

Olivine: $SiO_2 = 37.90$; $MgO = 41.65$; $FeO = 19.66$; $MnO,CoO = 0.42$.
Iron: $Fe = 82.45$; $Ni = 16.40$; $Co = 1.09$; $P = 0.05$.

The author regards this meteor, which was found in Carroll County, Kentucky, as part of the same mass from which the iron was obtained for making the iron ornaments found in the Turner and the Liberty groups of mounds in the Little Miami Valley, Ohio. The second mass was found near Catorze, San Luis Potosi, Mexico, in 1885. It weighs ninety-two pounds. Its composition (analysis by Mackintosh) is: $Fe = 90.09$; $Ni,Co = 9.07$; $P = 0.24$; schreibersite $= 0.60$. It resembles in character the irons of Augusta County, Va., of Glorieta[4] Mountain, and others of the class caillite (Meunier). In a cylindrical cavity in this meteor can still be seen the broken end of a copper chisel. ——The ninth meteoric iron which has actually been seen to fall has recently come into the possession of Mr. W. E. Hidden.[5] The mass weighed before polishing three thousand nine hundred and fifty grammes. It was seen to fall on the evening of the 27th of November, 1885, during the periodic star shower of the "Bielids." The location of the fall is near Mazapil, in the state of Zacatecas, Mexico. According to the belief of Professor

[1] Comptes Rendus, civ., Jan. 1887, p. 193.
[2] *Cf.* American Naturalist, Jan. 1887, p. 73; and Dec. 1885, p. 1213.
[3] Amer. Jour. Sci., xxxiii. p. 228.
[4] *Cf.* American Naturalist, Jan. 1887, p. 73.
[5] Amer. Jour. Sci., xxxiii., 1887, p. 221.

José A. y Bouilla, Director of the Astronomical Observatory at Zacatecas, this meteor represents part of the comet Biela-Gambert, lost since 1852. It is characterized by the freshness of its surface, which shows very perfectly the flow of the melted crust, and by the presence of unusually large nodules of a very compact graphite. For some time after its fall it remained red-hot. Its analysis yielded Mr. Mackintosh 91.26 per cent. of iron, 7.845 per cent. of nickel, 0.653 per cent. of cobalt, and 0.30 per cent. of phosphorus. Carbon is distributed all through the mass between the crystalline plates.——Mr. Huntington[1] calls attention to the fact that the Maverick County, Texas, meteorite[2] possesses many of the characteristics of the Coahuila irons, described by the late J. L. Smith, and from the similarity of the two concludes that the former must be classed as one of the latter, and should not be regarded as an independent fall.—— In connection with meteorites it may be of interest to note the discovery by Meunier[3] of little globules of a stony matter in the ashes of Krakatau. Upon examination they are found to be made up of little crystals of augite and plagioclase in a vitreous ground-mass. The author calls attention to the similarity between these bodies and the chondra of certain meteorites.

Recent Publications.—It is unfortunate that a treatise written expressly for the use of students should contain so many inaccuracies as are noted in the recent "Elements of Geology" by Professor A. Winchell.[4] Whatever may be said of the rest of the book, that portion which treats of petrography and the optical properties of minerals will not serve to give the beginner any definite idea of the fundamental principles upon which all rock classification is now based. Many of the statements made are, to say the least, misleading, and the definitions of the various rock types are unsatisfactory.——An excellent text-book of Mineralogy, by Max Bauer,[5] appeared about a year ago. It is by far the best book for general use in the class-room that has yet been published. The chapters on the development of the principles of crystallography are to be recommended as especially well adapted to the use of those beginning the study of the subject.——Ferdinand Henrich's[6] text-book of Mathematical Crystallography will fill a long-felt want of those who desire to gain some knowledge of the methods in use for the measurement and calculation of crystal forms, crystallographic constants, twinning planes, etc. The work is well written, and the directions given in it are all clearly and concisely expressed. Wherever it can aid the explanation of a difficult point examples

[1] Amer. Jour. Sci., xxxiii., 1887, p. 115. [2] *Cf.* Amer. Naturalist, Jan. 1887, p. 73.
[3] Comptes Rendus, civ., 1887, p. 95.
[4] Geological Studies, or Elements of Geology. Chicago: Griggs, 1886.
[5] Lehrbuch der Mineralogie. Berlin und Leipzig, 1886. J. Guttentag (D. Collin).
[6] Lehrbuch der Krystallberechnung. Stuttgart, 1886. Euke.

are introduced and calculations are made in full, just as in ordinary practice. Miller's system of indices is used throughout, and the rules for making spherical projections are developed at some length. This is the only elementary text-book in which the subject of spherical projection is given the attention it naturally merits as being the method which is now almost universally used by the most eminent crystallographers.

Among the publications of the last few months which contain more or less of interest in mineralogy and petrography may be mentioned—

Professor A. Kenngott, M.D.—Handwörterbuch der Mineralogie, Geologie und Palaeontologie, III. Breslau, 1887. Eduard Trewendt.

Dr. C. Rieman.—Taschenbuch für Mineralogen. Berlin, 1887. Julius Springer.

F. Toula.—Mineralogische und petrographische Tabellen. Leipzig. Freytag.

J. D. Dana.—Manual of Mineralogy and Petrography.[1] 4th ed., 1887. New York: John Wiley & Sons.

Professor W. O. Crosby.—Tables for the Determination of Common Minerals, chiefly by the Physical Properties, with confirmatory Chemical Tests.[2] Boston, 1887. A. Crosby.

Professor A. H. Chester.—Catalogue of Minerals Alphabetically Arranged, with their Chemical Composition and Synonyms.[2] New York, 1886. John Wiley & Sons.

T. Sterry Hunt.—Mineral Physiology and Physiography.[2] Boston, 1886. S. E. Cassino.

Professor W. O. Crosby.—Geological Collections. Mineralogy. Boston Soc. Nat. History, 1886.

A. C. Lawson.—Report on the Geology of the Lake of the Woods Region. Part CC. Annual Report of the Geological and Natural History Survey of Canada. Montreal, 1885.

C. D. Lawton.—Mineral Resources of Michigan for 1885. By authority. Lansing, 1886. Thorp & Godfrey.

Mineral Resources of the United States for 1885. Washington, 1886. Government Printing Office.

Dr. P. Groth.—Grundriss der Edelsteinkunde. Leipzig, 1887. Engelmann.

BOTANY.[3]

A Couple of Botanical Estrays.—A botanical discovery of some interest has recently been made in the neighborhood of Iowa City. Two species of Lycopodium have been found. So far as the writer can learn, this is the first record of such plants within the limits of Iowa. Lycopodium has been sought in all

[1] Reviewed in Science, 1887, p. 304.
[2] Reviewed in Science, February, 1887, p. 142.
[3] Edited by Prof. CHARLES E. BESSEY, Lincoln, Nebraska.

directions, but hitherto is not reported anywhere west of the Mississippi River, south of Pine County, Minn. The discovery is the more interesting when we know that the two species found, grow side by side within the limits of a very narrow area. A space ten by fifteen feet includes the entire station. All the hill-sides in the vicinity were searched in vain for other specimens. The plants did not fruit last year, are feeble, depauperate specimens of their species, and probably destined now to speedy extinction. The few white oaks, remnants of the "forest primeval," which have long afforded shelter, are now cut away, the hill-side becomes a pasture-field, and Lycopodium will be found no more.

To account for this isolated station, this peculiar distribution, is not easy. One is reminded of Scolopendrium, Shortia, and the like. Probably other stations will be found to the north which may serve to put these little specimens in geographical connection with their kin. This can hardly be the last tarrying-place of a plant which must at one time have covered all the northern portions of the State.—*T. H. McBride, Iowa City*, May 7, 1887.

The Origin of the Tomato from a Morphological Standpoint.[1]—There are two methods by which the cultivator can determine the origin of vegetables which have been long in cultivation. He can follow the history of the plant to its introduction into gardens and may then be able to identify it with a wild species, or he may reason from inference from the morphology and direction of variation of the plant in hand. The latter method may be illustrated by the tomato.

I will suppose, for my purpose, that no record exists as to the introduction of the tomato, or in regard to its characters, at any time before the present.

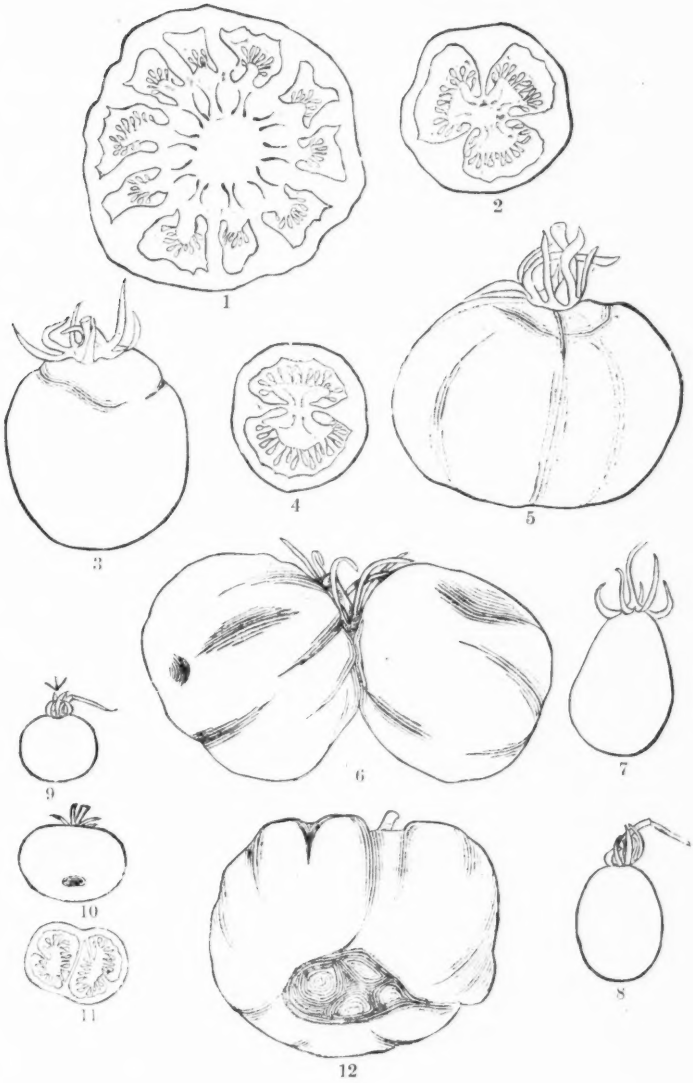
The fruit of the large tomato is seen at once to be extremely variable. This variability lies mostly in size, form, and number of cells. The number of cells, as seen in a cross-section of the fruit, may be taken as a measure of size and form. Fig. 1 represents a cross-section in which ten partial cell-divisions project from the walls of the fruit. This is a section of a Trophy. If we were to examine a hundred specimens of this variety we should find no two alike in shape and number of cells, and, consequently, in shape and size of fruit. Moreover, we should find the variations to be very great. Now, fruits in wild nature possess a definite number of cells, and of definite shape. The Trophy, then, is a monster; it is unnatural. To find a fruit nearer the original wild type we must find one more constant in its character. We examine critically every large-fruited sort,

[1] This paper is a revision and extension of one which first appeared in the *American Garden*.

and we find each one monstrous in regard to form and number of cells, but some are less so than others. The least monstrous are always those with the fewest cells. The fewest-celled fruits in our culture, then, must be nearest the original type. Fig. 2 represents a sectional view of a normal Criterion. The cells are three, incomplete. The fruit, Fig. 3, is oblong, mostly regular. The smallest, most regular specimens of this variety are incompletely two-celled, Fig. 4. On the other hand, abnormal specimens of this variety are many-celled, as shown by the partially-lobed fruit in Fig. 5. Occasionally the tendency to monstrosity extends to the flowers, and a twin is the result, Fig. 6. The Criterion presents nearly the whole record of development within itself. Its regular, small, normal, two-celled fruits approach the original type. Figs. 5 and 6 attest an excessive influence of cultivation. All the fruits here represented grew upon the same plant. The Criterion must be compared with the pear-shaped and egg-shaped sorts. Fig. 7 represents one of the Pear tomatoes. It is almost uniformly two-celled, or, in its larger form, the King Humbert, it becomes three-celled, and connects completely the Pear tomato and the Criterion. Below the Pear in point of development is the Plum tomato, Fig. 8. It approaches more nearly a spherical form, and is almost uniformly two-celled. Still lower is the Cherry tomato, Fig. 9,—the smallest and simplest of them all, and two-celled. This is our nearest approach to the wild type. The first tomato known to man could have been little else than this Cherry tomato. Here the cell-division is perfect, and gives every evidence of being normal. The first tomato must have been a two-celled fruit, and its shape spherical, or nearly so. The Pear tomatoes are also completely two-celled, —that is, the cell-division extends entirely across the fruit,—and this gives us reason to suppose that they may have existed in wild nature also. Granting this, they nevertheless give evidence of development from the Cherry tomato, as we have seen from the intermediate Plum varieties, Fig. 8. In cultivation they present fewer constant specific marks than the Cherry sorts.

Occasionally, however, the Cherry tomato broadens, as in Fig. 10, and becomes more or less completely three- or four-celled, Fig. 11. This figure shows the complete cell-division which separates the normal tomato into halves. This variation is the beginning of the flat and angular tomatoes. Small developments from it are Green Gage, Improved Large Yellow, and White Apple. As the fruits increase in size by the interposition of new cells, they take on abnormal shapes. Adventitious cells are often pushed into the centre of the fruit, giving rise to the familiar structure represented on the top of Fig. 12. Often the rupture caused by these adventitious cells takes the form of an irregular line rather than a ring, as in the illustration. Most of the large varieties of tomatoes give unmistakable evidence of development

PLATE XVIII.



from the Cherry tomato. So obvious is the direction and manner of variation in the tomato that among seventy-five varieties grown in our gardens last year there were none which refused to be classified, in relation to their origins and tendencies, as to whether the earliest variations had been directly from the Cherry tomato or through the Pear tomato. So clear does this manner of variation become, after a few weeks of study, that I am compelled to place more confidence in this method of ascertaining the origin of our cultivated tomatoes than in the records of old herbals.

We cannot so positively determine the color of the original tomato. Five-sixths or more of all our tomatoes are in various shades of red. From this fact we infer that red is the strongest and prevailing, hence the original, color.

The classification of cultivated tomatoes, upon morphological principles, may be represented as follows:

LYCOPERSICUM ESCULENTUM Miller, "Gard. Dict." (1768).

§ A. *Cerasiforme.*—Cherry tomatoes (*L. cerasiforme* Dunal, "Hist. Solan.," 113). Fruit spherical, two-celled,—the original type.

§ B. *Pyriforme.*—Pear and Plum tomatoes (*L. pyriforme* Dunal, l. c., 112). Fruit oblong or pyriform, two-celled, conspicuously pendent.

§§ A. *Vulgare.*—Plant weak, requiring support; leaves ordinary.

Group 1. Angular tomatoes. Fruit medium or below in size, mostly very flat, plane on top, more or less cornered, the lobes most conspicuous on the bottom and sides. Developments directly from the Cherry tomato, through the type of Improved Large Yellow, etc. Tom Thumb may be taken as the type of the group.

Group 2. Apple-shaped tomatoes. Fruit normally more or less rounded on top, most of the irregularities being due to the interposition of adventitious cells in the centre of the fruit. Direct developments from the Cherry tomato, through its longer and more regular forms. The "ringed" or "lined" character of the apex of the fruit is oftenest seen in this group. The Paragon may be taken as a type of the group.

Group 3. Oblong tomatoes. Fruit usually as long or longer than broad, the sides very firm. Developments from the pear-shaped variation. Criterion, in its normal forms, may be considered the type.

§§ B. *Grandifolium.*—Habit the same as in sub-section A; leaves very large; leaflets fewer (about two pairs), large (the blade three to four inches long and an inch and a half wide), entire, the lower side strongly decurrent on the petiolule. Leaves of very young plants are entire! Singular plants of recent development, represented by but few varieties, of which Mikado may be taken as type.

§§ C. *Validum.*—Stem very thick and stout, the plants nearly sustaining themselves; two to three feet high; leaves very dark green, short, and dense, the leaflets wrinkled and more or less recurved. Odd plants, with the aspect of potatoes, represented by French Upright and the New Station.

Another species, *Lycopersicum pimpinellifolium* Dunal, "Solan. Syn.," 3, the Current tomato, is cultivated as a curiosity.—*L. H. Bailey, Jr., Agricultural College, Mich.*

Experiments with Lima Beans in Germination.[1]—After reading some of the suggestive writings of Darwin, I began a few experiments with some Lima beans. About forty seeds were planted in the damp sand placed in a cellar. Of these twenty were placed on edge with the scar or hilum downwards, and twenty in a reverse position with the hilum uppermost.

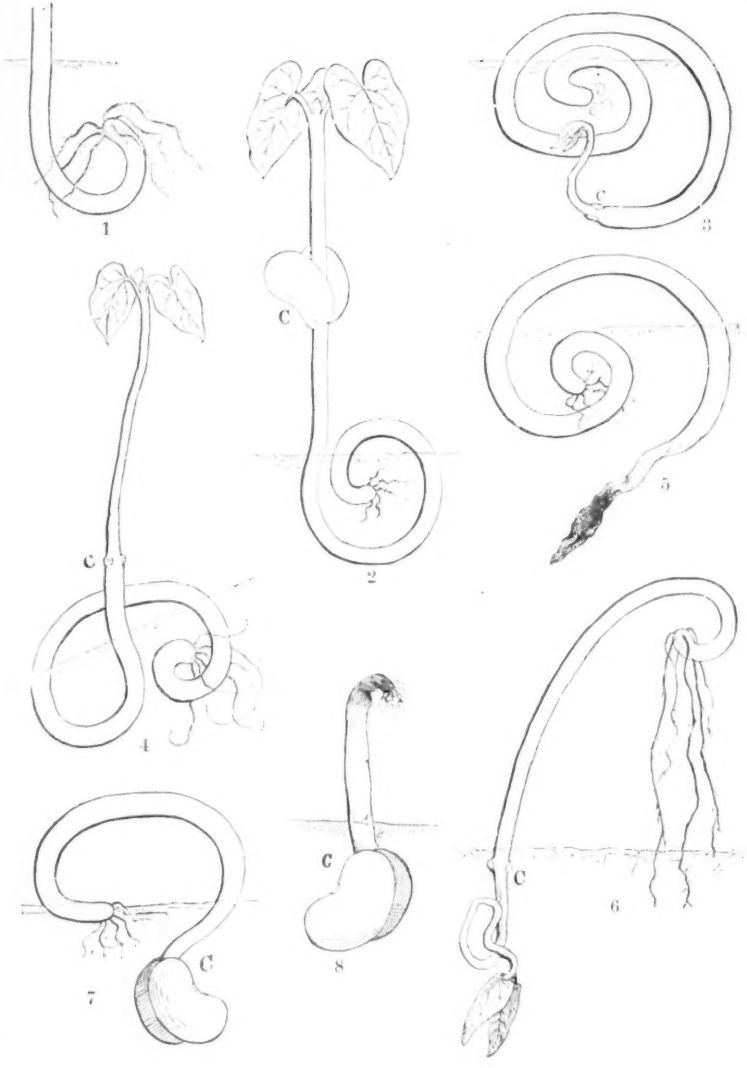
In most cases seeds of this species, when germinating, produce a long radicle, which carries the cotyledons some inches above ground. In this case two seeds produced a very short radicle,—perhaps half an inch long,—so that the cotyledons remained beneath the surface, as is usually the case with germinating peas. The beans planted with the eye down behaved well and came up promptly, all of them, while those placed in the reverse position went through with a great variety of manœuvres, and even then some of these perished in the attempt to make young plants. After some delay a considerable portion of them came out of the ground. Most of these bent the radicle into a half-circle, or, rather, that of an ox-bow, with one arm much longer than the other, carrying up the cotyledons. In making growth in the cellar nearly all of the young plants sent from one to several roots above the surface, where they usually re-entered the sand.

Four out of the twenty with the scar-edge up, after exhausting the nourishment stored in the cotyledons, perished in their attempts to make a successful growth. The lengthening radicle arched up out of the sand, but the plumule finally decayed.

In the sandy soil of my garden were placed twenty-five seeds in the manner last mentioned. A few came up very promptly, but for some time most of them seemed to rest beneath the sur-

[1] Read at the Montreal meeting of A. A. A. S. in 1882, and only a very brief abstract printed, without illustrations.

PLATE XIX.



face; but a week of rainy weather brought most of the rest to the surface in some form or other. Nine out of twenty-five sent the lower end of the radicle, with its roots, from three-fourths to two and one-half inches above the surface. The plumule for a time remained green, and the cotyledons were not yet exhausted; but in time all of these perished without bringing any green leaves to the surface.—*W. J. Beal, Agricultural College, Mich.*

EXPLANATION OF THE PLATE.

No. 1. The first of those to come up, where the hilum was placed uppermost, usually took the form of this figure.

No. 2. This represents one of those in which the hilum was placed uppermost.

No. 3. In this case the seedling is still struggling to send its plumule to the surface. The cotyledons, which were attached at C, have been rubbed off by the movements of the young plant through the sand.

No. 4. One plant is here represented in which the partially-exhausted cotyledons had been rubbed off.

No. 5. This represents one specimen in which the cotyledons have disappeared and the plumule has decayed.

No. 6. In this case the cotyledons have disappeared; the plumule and primary leaves were still green; some of the roots were still fresh in the soil, though the lower end of the radicle was elevated nearly three inches above the surface of the sand.

No. 7. Six out of twenty-five planted in open ground with the hilum uppermost were much like this figure, and likely to succeed in becoming good plants.

No. 8. Nine out of twenty-five planted as above in the open ground thrust the radicle with its roots nearly straight up out of the soil, sometimes as much as two and one-half inches, when the seedlings perished.

[All the figures were made by Will. Holdsworth.]

ENTOMOLOGY.[1]

Note on Respiration of Aquatic Bugs.—Among the most common insects found in our smaller ponds are those popularly known as "Water-Boatmen." Of these, the more abundant species pertain to two genera,—*Corisa* and *Notonecta*. In each of these genera the insect carries about with it, in its course through the water, a bubble of air, which it uses for respiration. At one time I kept for a considerable period several aquaria containing these insects upon the table where I was working. Some interesting phenomena connected with their respiration attracted my attention. Other duties interfered with the completion of my observations, and I now publish this note merely to call the attention of other observers to the subject.

The habits of the two genera are very different. In each the insect comes to the surface of the water at intervals to obtain a supply of fresh air; but in the case of *Corisa*, inhabiting well-aerated water, this does not seem to be absolutely necessary. The favorite attitude of the species of this genus when at rest is clinging to some object near the bottom of the aquarium; here they will remain for long periods, evincing no desire to rise to

[1] This department is edited by Prof. J. H. COMSTOCK, Cornell University, Ithaca, N. Y., to whom communications, books for notice, etc., should be sent.

the surface. The ventral aspect of the body at such times is covered with a film of air; and the space between the head and prothorax, and that between the prothorax and mesothorax, are also filled with air, as well as a space beneath the wings. But the quantity of air thus carried about by the insect is insufficient to account for the long period during which it remains beneath the surface of the water. By observing a *Corisa* when anchored near the bottom of a pond or aquarium, it will be seen that it clings by means of its anterior legs, and that the posterior legs are extended laterally and are frequently moved as when swimming. The result of this movement is to cause a current of water to pass over the film of air on the ventral side of the body. In this way the air may be purified as if in a tracheal gill. I was confirmed in the opinion that this air-film functions as a tracheal gill in two ways: first, when the water in which these insects were kept was allowed to become impure they became uneasy and frequently came to the surface for fresh supplies of air; second, in the case of *Notonecta* (the water-boatmen that swim upon their backs) the greater part of the air is carried beneath the wings; thus it comes in contact with the water but little, and is not, therefore, purified to any considerable extent by the free gases in the water. Correlated with this are habits very different from those of *Corisa*. The *Notonecta*, when at rest, almost invariably floats with the tip of its abdomen projecting from the water, in order that it may easily change the air under its wings.

In order to demonstrate the necessity for *Notonecta* to come to the surface frequently, I placed specimens in a closed vessel through which fresh water was allowed to run, but so arranged that the insects could not reach the open air. They made frantic efforts to push the tips of their bodies from the water. Failing in this, the air from beneath the wings in some way was accumulated on the ventral side of the body, where it at first formed a bubble of considerable size. This bubble was kneaded by the legs, and thus broken up into many small globules interspersed with water. After this the air was pushed back to the tip of the abdomen, and was again drawn under the wings. Thus it seems that the *Notonecta* can, in an emergency, avail itself of a method of purifying its supply of air, which, with the *Corisa*, is normal. I doubt, however, whether the *Notonecta* could keep itself alive in this way for a long period.—*J. H. Comstock.*

Pedigree Moths.—In a paper upon "Pedigree Moths," read before the London Entomological Society, February, 1887, Mr. Francis Galton, F. R. S., explained the plan and object of his proposed experiments in breeding moths, with the view of obtaining certain hereditary data needed to confirm results gained in the course of previous experimental research, when other sub-

jects than moths were treated. Mr. Galton says, "It is intended, in each case, to procure broods through a succession of selected specimens, along three lines of descent from a single pair of individuals, so that there will be three parallel broods in each generation. The particular characteristic that is selected for these experiments must admit of being accurately measured; in other respects the choice is immaterial. For brevity of explanation, I will suppose it to be size; then, starting from the brood of the original pair, (1) a few of the largest of either sex would be separated and mated; out of their progeny a few of the largest would again be taken and mated, and so on, for several generations. (2) Exactly the same process just described would be gone through, after substituting throughout the words 'medium-sized' for 'largest.' (3) Similarly, after substituting the word 'smallest' for 'largest.' The result will be to obtain a precise measure of the diminution of rate at which a divergence from the average of the race proceeds in successive generations of continually-selected animals."—*Entomologist*, vol. xx. p. 60.

Ears of Insects.—A correspondent calls attention to the statement made by Professor Packard, in the March number of this magazine, that locusts and grasshoppers have been "proved" to have ears. In opposition, he quotes from Dr. C. S. Minot's "Comparative Morphology of the Ear" (*Am. Jour. Otology*, iv., April, 1882), as follows: "All attempts, however, to demonstrate the existence of an auditory organ in insects have hitherto failed. The only organs which might be interpreted as answering functionally to an ear are the so-called tympanal organs of Orthoptera; but it has not yet been demonstrated that these peculiar structures do really subserve the sense of hearing." After an abstract of Graber's researches on these organs, Dr. Minot concludes, "The preceding accounts show that we have to do with unquestionable sense-organs, although of a very unusual character. . . . As to their probable functions, we possess no satisfactory indication; but it seems particularly improbable that they are auditory organs." And again, "It is certain that they are of much importance, but their physiological rôle is, we repeat, unknown."

Relations of Ants and Aphids.—As bearing upon our note on this subject in the NATURALIST for April, Professor Forbes writes as follows: "I find that, by leaning too heavily upon a considerable amount of negative evidence collected last year and the year preceding, I made an error last summer in the life-history of the corn plant-louse, *Aphis maidis*. We have succeeded this spring in finding the eggs of this species in the nests of *Lasius alienus*, in fields of corn infested by the lice the previous year, have hatched these eggs in the office, and have reared

them upon corn-roots exposed in glass tubes until all question of their specific character is removed. We also find that the ants rear the young, before the ground is planted, upon the roots of *Setaria* and *Polygonum*, common weeds in the fields, transferring them afterwards to the young corn. I judge, from the activity of the ants and the arduous character of their labors in the spring, before the plant-lice have become available as a means of subsistence, that they have independent resources. In a single instance we found dead *Bibio albipennis* dragged into the nest; but, like so many other insects at this season, the ants probably feed largely upon the fluid exudations of plants."

Exposition of Insects.—There will be held in Paris, beginning on the 27th August and lasting until 28th September, 1887, an exposition of useful insects and their products, and of noxious insects and specimens of their injuries. This exposition is conducted by the Société centrale d'Apiculture et d'Insectologie, under the patronage of the Ministre de l'Agriculture. There is also to be given in this exposition a place for insecticides, and various devices for destroying insects. It is to be opened to foreign as well as French exhibitors.

Entomological News.—Mr. L. O. Howard gives, in the *Transactions of the American Entomological Society*, vol. xiii. pp. 169–178, a generic synopsis of the *Proctotrupidæ*, based upon that which appears in Dr. Foerster's "Hymenopterologische Studien." The synopsis includes one hundred and thirteen genera, of which twenty-nine are represented in this country; these are indicated by an asterisk.——In the same volume, p. 179, Mr. Charles A. Blake gives a monograph of the *Mutillidæ* of North America. The genera, and also the species, are separated by analytical tables. Many new species are described, bringing the number of known species up to about one hundred and thirty.——Williston also gives (l. c., p. 308) a catalogue of the described species of South American *Syrphidæ*. About three hundred species, representing about forty genera, are enumerated.——Dr. Gustav Mayr publishes a paper on the ants of the United States of America, in the *Verh. k. k. Zool.-Bot. Ges. in Wien*, pp. 419–468. This paper is a synonymical and descriptive list of forty-eight pages, in which one hundred and seven species, representing thirty-four genera, are given. Fourteen new species are described.——Mr. Grote has published, in Bremen, a small work on the "Hawk-Moths of North America."——Dr. Riley has published Bulletin No. 10 of the Division of Entomology, U. S. Dept. Agr., entitled "Our Shade-Trees and their Insect Defoliators, being a consideration of the four most injurious species which affect the trees of the Capital, with means of destroying them." The imported elm-leaf-beetle, the bag-

worm, the white-marked tussock-moth, and the fall web-worm are the insects discussed.——The *Proceedings of the Natural History Society of Wisconsin* for April devotes forty-two pages to a paper on the special senses of wasps, by G. W. and E. G. Peckham.

ZOOLOGY.

The Fauna of Liverpool Bay.—A short time ago, at the instigation of Professor W. A. Herdman, of Liverpool, England, the "Liverpool Marine Biological Committee" was formed, the object of which was to explore the fauna of Liverpool Bay and the adjacent seas. The first report of this committee has recently been published, and occupies three hundred and seventy pages, with ten plates and two maps, of vol. xl. of the "Proceedings" of the Liverpool Literary and Philosophical Society. Persons interested loaned tugs and steamers for the purposes of dredging, and the additions made to the knowledge of the fauna of the Irish Sea are very considerable. The specimens collected were turned over to specialists to work up, and from their reports and lists of species it has been found that of the nine hundred and thirteen species recorded, two hundred and thirty-five were new to the region embraced; sixteen were never before reported from the British seas, and of these seven species and three varieties are new to science. Of the special reports on the different groups we can only allude to Professor A. Milne Marshall's excellent sketch on shallow-water faunas, and that of the Rev. H. H. Higgins on pioneers in local biology. Professor W. A. Herdman in a supplementary paper deals with variability in the tunicates, while J. H. Gibson discusses the systematic value of the spines of the polychætous worms, coming to the conclusion that they are of but moderate importance. There are a few notes on the attempted introduction of the quahog (*Venus mercenaria*), which does not appear to have been successful. Among the projects outlined for the future is a systematic examination of the fauna between tide-marks. This littoral zone is to be divided into belts, corresponding to its elevation above low-water mark, and each belt is to be examined separately with a view of ascertaining, among other points, the daily submergence which each species requires.

The Systematic Position of the Sponges.—Dr. G. C. J. Vosmaer, in the concluding portion of his volume on the Porifera in Bronn's "Klassen und Ordnungen des Thierreichs," discusses the various views held as to the relationships of the sponges, and advances some ideas of his own, which, from his familiarity with the subject, are worthy of attention. He divides the sponges

into two great groups, Calcarea and Non-Calcarea, maintaining that the two are perfectly distinct, and that there are no osculant forms. He divides the Non-Calcarea into Hyalospongiæ (=Hexactinellidæ *Auct.*), Spiculispongiæ, and Cornacuspongiæ, the limits between which are not so distinct as those between the groups first mentioned.

As to the origin of the sponges, Vosmaer claims that our embryological knowledge is still insufficient to decide, but still that there is some reason for the belief that their ancestor was a free-swimming form, which may have been like the larva of some silicious sponge. The larva of Sycandra is too aberrant to hold the position of representative. First to be settled is the point whether the sponges are to be regarded as Protozoa, Cœlenterates, or an independent group. Vosmaer takes the latter view, and quotes in support Balfour, Heider, Bütschli, and Sollas, but fails to refer to Hyatt, who antedates them all in holding this opinion. His reasons are both structural and embryological. He fails to see that the sponges are degenerate Cœlenterata,—as is held by most continental students,—and claims that while the silicious sponges are degenerating, the Calcarea and the Cornacuspongiæ are advancing. In development the Spongiæ and the Cœlenterata have nothing in common beyond the gastrula stage. That the sponges have indirectly descended from the Protozoa Vosmaer thinks probable, but he is at a loss for the transition stages, as he does not accept the views of the late Henry James Clarke, which, by the way, he attributes to Saville Kent. Balfour's amphiblastula theory is dismissed with few words as set aside by Heider, while Heider's own theory receives scarcely more mention. For himself he has now new ideas to advance. He thinks that the first sponges were deep-sea forms, and ultimately developed a stony silicious skeleton, which degenerated to at least a considerable extent when the forms entered shallower cases.

Parasitic Sea-Anemones.—Prof. A. C. Haddon enumerates (*Sci. Proc. Roy. Dublin Socy.*, v. pp. 473–481, 1887) the known parasitic larvæ of the genera variously known as Bicidium, Peachia, Philomedusa, and Halcampa. This group is known on our coast by a form first described by Mr. Alexander Agassiz as *Bicidium parasiticum*, but which has since been referred to the two genera Peachia and Philomedusa, the latter of which will now have to lapse into synonymy. *Peachia parasitica* is a small sea-anemone an inch or two in length, which is usually formed, as its name implies, parasitic in the folds around the mouth of the large brown or purple jelly-fish, *Cyanea arctica*. Haddon has some remarks on the number of tentacles and mesenteries in these forms, which lead him to the conclusion that the three families in which these parasitic sea-anemones occur are more

closely related than is usually thought to be the case. A detailed account of the British species of Halcampa is promised.

Chætonotus.—Dr. A. C. Stokes has catalogued the American and some of the foreign species of Chætonotus in the *Microscope* (vol. vii. pp. 1 and 33, 2 pls., 1887). Of the species twenty are enumerated. *Chætonotus sulcatus, concinnus, loricatus, rhomboides, spinifer, acanthodes, octonarius, spinulosus, longispinosus, enormis,* and *acanthophorus* (11) are described as new from New Jersey. *Ch. podura, maximus,* and *larus* of Ehrenberg are regarded as common to both Europe and America, while the other six species catalogued have not been seen by this observer in America. The paper is preceded by a few notes on their anatomy and a few observations upon their eggs, which pass through their development, from segmentation to hatching, in thirty hours. Dr. Stokes, it may be said in passing, unites Ichthydium with Chætonotus, a step of doubtful propriety, while no mention is made of the other genera of the class Gastrotricha, to which these worms belong. Dr. Stokes's paper has been reprinted in Pelletan's *Journal de Micrographie.*

Anatomy of Pseudoscorpions.—Croneberg gives (*Zool. Anzeiger,* No. 246) a preliminary account of the anatomy of Chernes, one of the Pseudoscorpions. The sucking pharynx is moved by dilator muscles, the contraction being effected by the elasticity of the strongly chitinized wall. The œsophagus is narrow, but widens out for the short stomach, and then at once contracts to form the intestine. With the stomach are connected the three (one medium, two paired) hepatic sacs, the lateral ones being divided into eight secondary lobes. The unpaired and inferior sac, among other substances, secretes a chalky-white substance which forms the exclusive contents of the intestine. The brain, heart, and genitalia are described. Croneberg, however, could find no traces of the spinning-glands described by Menge as occurring at the tip of the abdomen, where indeed he thinks it would be poorly adapted for the animal's needs. Croneberg rather seeks the spinning organs in two glands above the brain, the ducts of which terminate at the tips of the movable joints of the cheliceræ. Menge claims to have witnessed these animals spinning their small protective webs, but this Croneberg does not appear to have seen.

Description of a New Species of Fruit-Pigeon (*Janthœnas jouyi*) from the Liu Kiu Islands, Japan.

Janthœnas jouyi, sp. nov.

DIAGNOSIS: Similar to *Janthœnas ianthina* (Temm.), but with a large white patch on the lower hind neck and the anterior portion of the interscapilium; metallic reflections on scapulars and back bronzy green, not purple as in *J. ianthina.*

DIMENSIONS: Wing, 253 mm.; tail-feathers, 188 mm.; exposed culmen, 23 mm.; tarsus, 35 mm.; middle toe, with claw, 51 mm.

SYNONYMY: *Carpophaga ianthina* Seebohm, Ibis, 1887, p. 179 (*part*).

HABITAT: Liu Kiu Islands, Japan.

TYPE: Tokio Educational Museum, C. Tasaki coll., February 3, 1887.

Other specimens of this very distinct species have been obtained by Mr. H. Pryer's collectors in the Liu Kiu Islands. I take great pleasure in dedicating it to my friend, Mr. P. L. Jouy.

I wish also to express my indebtedness to the authorities of the Tokio Educational Museum for the opportunity to describe this interesting novelty.—*Leonhard Stejneger.*

Zoological News.—PROTOZOA.—J. H. Siddall, in his report on the Foraminifera of the Liverpool Marine District (*supra*), gives the following account of the method of collecting these forms. Foraminifera, he says, "may always be got by carefully scraping the surface of the velvety brownish mud at the bottom of pools left by the tide. . . . The oozy mud may be got rid of by washing through a fine muslin net, and the residuum put into small bottles filled with sea-water. The bottles should be kept uncorked in a cool place, out of direct sunlight, when the Foraminifera will creep up the sides of the bottle and live there for months."

SPONGES.—Prof. P. Martin Duncan and Dr. G. J. Hinde are having an animated discussion in the pages of the *Annals and Magazine of Natural History* over the name to be applied to the fossil sponge Hindia of Tennessee.

Mr. H. J. Carter (*Ann. and Mag. N. H.*, April, 1887) describes a new species of fleshy sponge from Australia under the name *Chondrosia spurca*, which is remarkable from the immense amount of foreign material (more than half its bulk in one instance) which it incorporates in its tissues.

VERTEBRATA—FISHES.—*Linophryne lucifer*, recently described in the *P. Z. S. of London*, by Robert Collett, is a singular, small Ceratian with an enormous head and mouth, a single cephalic tentacle to represent the spinous dorsal; immensely long and slender teeth on the jaws and vomer (also teeth on upper pharyngeals); very narrow gill-openings; very short soft dorsal and anal, and no ventrals. The abdominal cavity forms a sac suspended from the trunk, and projecting backward beyond the tail. There is a long tentacle on the throat. The specimen was taken off Madeira.

G. A. Boulenger has recently described a Ctenopoma, a Clarias, and a Mormyrus, from the Lower Congo. All have native names; also three new South American Characinoids.

REPTILES AND BATRACHIA.—Mr. G. A. Boulenger describes a new Calamaria, from Borneo, in the *Annals and Mag. Nat. Hist.* (March). He also notes that *Elaphis grabowskyi* Fischer, from Southeastern Borneo, is identical with *E. tæniurus* Cope. The latter snake has a wide range, since specimens have been obtained from Pekin, Darjeeling, Siam, and Sumatra.

Mr. G. A. Boulenger makes some remarks (*Ann. and Mag. Nat. Hist.*, March) upon the fresh-water turtle recently described by Mr. E. P. Ramsey in the *Proc. Linn. Soc. N. S. W.* This tortoise (*Carettochelys*) was obtained in the Fly River, New Guinea, and is stated to be one of the most striking discoveries made in recent herpetology during the last twenty years. It differs from all fresh-water turtles by the structure of the limbs, which form regular paddles, and have only the two inner digits clawed. Epidermic scutes are absent. Mr. Boulenger makes it the type of a family of Pleurodira,—Carettochelydidæ.

G. A. Boulenger has recently described *Rana martensii*, from Japan; *Ixalus asper*, from Perak; and *Geomolge fischeri*, from the river Ussuri, in Mantchuria. Also a new frog, of the genus Megalophrys, from Perak.

BIRDS.—Mr. F. E. Beddard states that the air-sacs of Casuarius resemble those of Apteryx much more closely than those of Rhea.

The same anatomist has examined the structure of the syrinx in various Caprimulgidæ. Though the Guacharo (Steatornis) stands alone in having a purely branchial syrinx, yet Podargus and Batrachostomus are transitional between Steatornis and other Caprimulgidæ.

Those interested in pterography will find, in the *Proceedings Zool. Soc. London*, April, 1886, a valuable paper, with illustrations, upon the disposition of the cubital coverts. Mr. Goodchild remarks that, up to a certain point, there is a remarkable correlation of particular styles of imbrication of the cubital coverts with certain structural peculiarities,—osteological, myological, visceral, and pterographical.

Mr. H. B. Tristram (*P. Z. S.*, January, 1886) describes *Dafila modesta*, a fourth species of the genus, from Sidney Island, Phœnix Group (lat., 4.30° S.; lon., 171.20° W.).

Mr. P. L. Sclater has described a new flamingo (*Phœnicopterus jamesi*), from Tarapaca, Chili. Three specimens were obtained by Carlos Rahmer, at a height of about twelve thousand feet, at the foot of the Tsluga Volcano. The bill is shorter and smaller than in *Ph. andinus*, the naked space at the lores wider, the upper mandible narrower, and there is less black at the tip. The legs of the species are red.

MAMMALS.—The British Museum has lately received, along with the magnificent collection of East Indian birds donated by

Mr. A. O. Hume, about four hundred examples of mammals, referable to two hundred and six species. The collection is geographically valuable, since it comprises four separate series, obtained, respectively, at Sambhur in Rajpootana, Manipur (northwest of Birmah), Tenasserim, and the Malay Peninsula. Sambhur fixes the limit at which the fauna begins to lose its ordinary Indian character, and to show signs of the desert character of Sinde and the Punjab. *Felis chaus*, *F. torquata*, *F. ornata*, *Viverricula malaccensis*, *Paradoxurus niger*, *Herpestes griseus* and *H. smithii*, and *Mellivora indica* occur among the specimens. The Manipur fauna is decidedly Himalayan. A new variety of *Herpestes auropunctatus* and a new Mus. (*M. humei*) are the novelties, and *Sciurus indicus* has its known range extended from Nepal to Manipur. *Semnopithecus femoralis* is added to the Tenasserim fauna, and among the Malay specimens is a beautiful new Sciuropterus (*S. davidsoni*).—*P. Z. S.*, January, 1886, Mr. O. Thomas.

Mr. R. A. Sterndale notes the certain occurrence of a natural hybrid between *Ovis hodgsoni* and *O. vignei*, due to a ram of the former and larger species appropriating the ewes of a herd of the latter. The ram was killed by wolves, and in course of time the hybrids, crossed with *O. vignei*, showed signs of reversion to that type.

Part I. of vol. clxxvi. of the *Philosophical Transactions of the Royal Society of London* contains two portions of W. K. Parker's work upon the structure and development of the skull in the Mammalia. The first part is devoted to the Edentata, the second to the Insectivora. Thirty-nine plates illustrate these treatises.

Mr. O. Thomas describes (*Ann. and Mag. Nat. Hist.*, February) *Pseudochirus forbesi*, a new Papuan phalanger similar to *Ps. canescens* Waterhouse. An adult male was 280 mm. long without the tail, which measured 230 mm. It was found in the Astrolabe Mountains of Southeastern New Guinea, at a height of two thousand feet.

Mr. Thomas also diagnoses *Nesonycteris woodfordi* and *Pteropus grandis*, two new fruit-eating bats from the Solomon Islands.

Dr. Monticelli contributes to the *Proceedings of the London Zoological Society* a list of the South Italian Chiroptera, including eighteen species.

Mr. O. Thomas has described and figured, in the *Proc. Zool. Soc.*, two skulls of *Mustela pennantii*, which, though both adult, exhibit variations such as have often given foundation for the description of new species. The development of the temporal muscles has expanded the zygomatic arches, absolutely constricted the anterior part of the skull, and narrowed the posterior narial passage in the older skull.

One of the most singular of rodents is *Heterocephalus phillipsi*, from Somali-land. It is of about the size of a mouse, but, from its hairless skin, small eyes, and peculiar head, looks more like

a tiny puppy. The ears are simple, round holes, without a conch, and the eyeballs are barely half a millimetre in diameter. Another species, *H. glaber*, was described by Rüppell forty years ago. It is a burrower, the skin passing across the mouth inside the incisors.

EMBRYOLOGY.[1]

Suggestion respecting the Epiblastic Origin of the Segmental Duct.—In a recent paper[2] with the above title, Prof. A. C. Haddon, of Dublin, offers a very suggestive explanation of the origin of the paired parallel segmental ducts of vertebrates from lateral, longitudinal grooves in some primitive, ancestral form, these grooves finally closing so as to form lateral ducts, which, at last, became confluent posteriorly with the cloaca.

Professor Haddon cites Hensen, Spee, and Flemming as having observed the origin of the segmental ducts from the epiblast in the rabbit and guinea-pig. Later (1886), Dr. Van Wijhe found the same to be the case in *Raia clavata*, and afterwards Dr. Perényi observed the same mode of development to obtain in *Rana esculenta* and *Lacerta viridis*.[3]

"The origin of the segmental duct from the epiblast being now known to occur in Elasmobranchs, Anura, and Rodents, we are justified in assuming that this is a general and probably primitive mode of formation. With the above-mentioned exceptions, all embryologists who have recorded observations on the development of the duct agree in stating that it is at first placed immediately below the epiblast, and that it gradually sinks within the mesoblast until it comes to lie close to the peritoneal epithelium; they also all agree in deriving the duct from the somatic mesoblast.

"The duct arises, in the Rodents, as a linear proliferation of the epiblast, in the region opposite to the intermediate cell-mass ('*Grenzstrang*' of Hensen). Flemming points out that the area is of variable length, not even being symmetrical. The separation of this solid cord of cells from the epiblast takes place from before backwards, and first occurs at a time when the mesoblastic somites are still entirely continuous with the ventral (somatic and splanchnic) mesoblast. Hensen, Spee, and Flemming conjectured that the primitive kidney is itself developed from the epiblast in these mammals; but of this they produce

[1] Edited by Prof. JOHN A. RYDER, Biological Department, University of Pennsylvania, Philadelphia.

[2] The Scientific Proceedings of the Royal Dublin Society, v., pt. vi., 1887, pp. 463–472, pl. x.

[3] [The editor would here, for the first time, record the fact that he has found the anterior ends of the segmental ducts intimately connected with the epiblast in young embryos of the catfish (*Amiurus albidus*), so that the mode of origin of the segmental duct spoken of above very probably applies also to the Teleostei.]

no direct evidence. It is more probable that the nephridia are of mesoblastic origin, as in other vertebrates.

"Van Wijhe finds that in the ray the pronephros (*Vorneire*) arises at the commencement of Balfour's stage I., as a continuous evagination from the somatopleure on each side of the body throughout five somites. When the hinder end of this evagination reaches the skin it fuses therewith, and the place of fusion is the rudiment of the duct of the pronephros (segmental duct). This grows posteriorly, gradually separating from the skin, so that its latest-formed end is always fused with it. The mesonephros (*Urniere*) is developed shortly after the appearance of the pronephros.

"In the frog Perényi finds that the duct develops as a canal-like separation from the inner (nervous) cell-layer of the epiblast, which later associates itself with the mesoderm cells of the intermediate cell-mass (*Grenzstrang*).

"According to the usually-received account, formation of the segmental duct may take place in two ways,—(1) either by the closing in of a continuous groove of the somatic peritoneal epithelium (Cyclostomi, anterior end only; Lepidosteus, Teleostei, Amphibia); or as a solid knob or rod of cells derived from the somatic mesoblast, which grows backwards between the epiblast and the mesoblast (Cyclostomi, posterior portion; Elasmobranchii, Amniota)."

At this point Professor Haddon further cites the literature, giving especial prominence to the views of Balfour on this difficult problem as discussed in his "Comparative Embryology," vol. ii. He then refers at length to the view propounded by Sedgwick in his well-known memoir, "On the Origin of Metameric Segmentation," and cites Lang, who says, "In certain Polyclades [Turbellaria] ramifications of the intestine open to the exterior by excretory pores, either on the dorsal surface (*Planaria aurantiaca* d. Ch.), or on the lateral edge (as in a very interesting new genus of the family of Proceridæ), thus forming a complete analogy with the excretory pores which are found at the edge of the bell in certain Medusæ.

"The aquiferous system characteristic of other Platy-elminthes does not occur in the Polyclades. The secretory organs of these animals are formed after the type of those of the Cœlenterata. Excretion in the two groups is performed by means of diverticula from the intestine which open to the exterior."

Van Wijhe's view is briefly summarized to the effect that the primitive Craniota had no pronephric duct, the pronephros opening outwards by a pore from the gland. Later, this orifice migrated backward and its outer border developed into the duct, and, approaching the cloaca, blended with and opened into it. He also thinks that the epiblastic origin of the segmental duct will not be welcome to those who think that the Chordata were

descended from Annelids; but, for his part, he cannot admit the relationship between these types.

Professor Haddon then states his own view, as follows: "Without at all committing myself to a belief in the ancestry of the Chordata from Chætopod worms, I would offer the following considerations as tending to show that the vertebrate excretory system is readily comparable with that of Annelids, now that the epiblastic origin of the segmental duct has been established.

"It is perfectly well known that the nephridia of all invertebrates open directly to the exterior, and in the segmental worms there are typically a pair of nephridia for each somite.

"It is generally admitted that the early (not necessarily the *primitive*) Chordata were segmented, and it is not unreasonable to suppose that the nephridia were segmentally disposed, as there is usually a marked segmental arrangement of the nephric tubules in ontology. The peripheral orifices of the nephridia must either have opened directly to the exterior or from the first debouched into a longitudinal canal. Various theories have been framed to explain the latter arrangement, but the former condition is undoubtedly more easily conceived, one difficulty in this supposition being,—What has become of the primitive external openings?

"Accepting the proposition that in the primitive Chordata nephridia opened directly to the exterior, we have only to assume that the lateral area along which they opened was grooved, and that this groove extended posteriorly as far as the anus.

"From the analogy of the neural groove there is no great difficulty in further supposing that the nephric groove was converted into a canal, which, becoming separated from the overlying epiblast, might sink into the deeper-lying parts of the body.

"If a suggestion may be hazarded concerning the advantage of converting the nephric groove into the nephric duct, it may be pointed out that the lateral openings of the nephridia would not be far removed from the branchial clefts, and the need of pure water for respiratory purposes is emphasized by the now acknowledged fact that each cleft was provided with its own sense-organ (now metamorphosed into the 'thymus gland'). The development of the duct from before backward supports this view.

"From recent researches on the lamprey (Shipley), newt (Alice Johnson), Alytes (Gasser), and frog (Spencer), it has been proved that in these forms the blastopore never closes up, but persists as the anus (*i.e.*, the opening of the mesenteron into the cloaca).

"We are justified in assuming the persistence of the blastopore as the anus in early Chordata; thus, if the nephric groove were continued round to the anus it would practically open into

the extreme hinder end of the mesenteron,—in other words, into the urodæum (Gadow).

"Probably about the same time that the nephric groove was being converted into the nephric canal (segmental duct) the proctodæum was being invaginated. The latter would push before it the posterior orifice of the nephric canal.

"The nephridia themselves appear to be of mesoblastic origin. It is possible that the *Archinephros* extended throughout the greater length of the body, as in Chætopod worms, but that in time an anterior section (pronephros) came to be developed earlier than the posterior portion (mesonephros).

"The precociousness in the development of the segmental duct in ontogeny is not necessarily a difficulty, as it can be paralleled by many other organs.

"On the hypothesis just sketched out the nephridia always open by their original epiblastic pores,—primitively, directly to the exterior; secondarily, into a canal separated from the epiblast: also the archinephros could be equally effectively functional throughout the whole period of its modification."

ANTHROPOLOGY.

Folk-Lore.—No other branch of anthropology is making more rapid progress than Folk-Lore, "or the popular explanation of observed facts and the customs arising therefrom." Sir R. C. Temple is the last to develop a scheme of the subject, on the spirit basis, as applicable to India. It is so comprehensive that it is given below in full, and may be easily adapted to any area:

SPIRIT BASIS OF BELIEF AND CUSTOM.

I. RELIGION.

A. Spirit-Worship.

Ancestor-worship.
Ancestors become guardians.
  Spirits as guardians.
  Badges or Devaks.
Spirits are mortals.
Spirits cause disease.
  Effects of this belief.
  Ornaments intended to scare spirits.

Articles which scare spirits:

Fire,	Ashes,	Breath,	Colors,
Water,	Beating,	Brooms,	Coral,
Metal,	Bells,	Canes,	Cross,
Urine,	Blood,	Circles,	Crown,
Arches,	Bread,	Clothes,	Dancing,

Dung,	Garlic,	Leather,	Salutation,
Earth,	Glass,	Lime,	Shells,
Eggs,	Grass,	Lifting,	Spirits,
Feasting,	Grain,	Noise and music,	Spittle,
Feathers,	Honey,	Oil,	Sulphur,
Flags,	Horns,	Ornaments,	Sugar,
Flowers,	Incense,	Precious stones,	Tattooing,
Fruit,	Indecency,	Ribbons,	Threads,
Food,	Kiss,	Salt,	Umbrellas.
Foam,			

B. Classes of Spirits.

Air-spirits:

Satkuvaris,
Vij, or Spirit of Lightning.

Epidemic-spirits.

Earth-spirits:

Vetal,	Bhairoba,	Jakhai,	Mukai,
Bramapurush,	Cheda,	Jokhia,	Navlai.

Water-spirits.
Underground-spirits.
Spirits generally.
Features, character, and mode of living spirits.

Spirit-haunts:

Funeral-places,	Groves, hills, heaths,
Boundaries,	House-roofs,
Roads and cross-roads,	Looking-glasses,
Stones, trees, caverns,	River-banks and sea-shores,
Deserts and waste-places,	Unclean places,
Empty houses,	Water- or pot-holes.

C. Spirit-Possession.

Into whom they enter.
Fear chief disposing cause.

Spirit-entries:

Head,	Mouth,	Yawning,	Feet,	Nose.
Hair,	Sneezing,	Hands,	Ears,	

Spirit-seasons:

Eating.
Times of meeting and bargain.
Auspicious events.
New-moon and full-moon days.

Effect of spirit-possession.	Black art.
How spirits are kept off.	Evil eye.
Exorcists.	Ceremonial impurity.

D. Stone-Worship.

E. Tree- and Plant-Worship.

Trees as old homes of men.
Sacred groves.

Food- or fruit-trees :

Cocoa-palm,	Pomegranate,	Plantain,
Mango,	Betel-palm,	Date.

Liquor-yielding trees,	Fire-yielding and evergreen trees,
Incense-yielding trees,	Plant-worship,
Healing trees and plants,	Grass-worship.

F. Animal-Worship.

Metempsychosis.

Home-haunters :

Ape,	Fly,	Dove,	Crow,	Mouse,
Ant,	Cock,	Rat,	Frog,	Serpent.

Tomb-haunters :

Bat, Owl.

Man-eaters :

Alligator,	Tiger,	Crocodile,	Lion,	Bear,	Vulture,
Dog,	Wolf,	Eagle,	Eel,	Hyena,	Tortoise.

Healers :

Ass,	Hare,	Deer,	Peacock,	Horse,
Cow,	Parrot,	Hog,	Swan,	Cat,
Goat,	Goose,	Fish,	Camel,	Kite,
Sheep,	Buffalo,	Jackal,	Elephant,	Spider.

G. Man-Worship.

Apotheosis :

Devarshis, or Bhagats,	Sons-in-law,
Guests,	Prostitutes and low women,
Husbands,	Dead kings and dead pious.
Kumaukas,	

H. Classes of Gods.

Primitive theology,	Local gods,	Planet-worship,
House-gods,	Fire-worship,	Water-worship,
House-goddesses,	Sun-worship,	Earth-worship,
Village-gods,	Moon-worship,	Mountain-worship.

I. Immortality of the Soul.

J. Sects.

K. Priestly Classes.

Aged relations,
Castemen,
Headmen,
Women,
Potters,
Washermen,
Dancing-girls,
Early tribes or lower classes.

L. Offerings.

Origin of religious offerings.
Human sacrifices, Animal sacrifices.

M. Object of Ritual is to Scare Spirits.

Spirits attack the object of worship.

Baptism,
Confirmation,
Matrimony,
Sick,
The dying,
Burial,
Consecration of new house,
Consecration of new image,
Nagbali.

N. Festivals.

Makarsankranti,
Ratha Saptami,
Mahashivrata,
Holi, or Hutashani,
Varshapratipada,
Ramanavami,
Gokulashtami,
Shravani,
Dasara,
Divali,
Balipratipada,
Bhaubija.

To prevent attacks of spirits.

II. CUSTOMS.

P. Birth-Customs.

Peril of childbirth varies with race.

Birth-rites:
Deshasth Brahmans,
Kolaba Kunbis,
Puna Ramoshis.

Fifth- or sixth-day birth-rites:
Bombay Yajurvedi Brahmans,
Khandesh Bhils.

The cleansing of the mother.
The purification of the child.
Naming.

Spirit-scarers used in birth-rites:

Fire, Yellow, Noise, Liquor, Metal.
Feasting, Water, Red, Urine,

Couvade.

Q. Marriage.

Hindu marriage-rites.

Child-marriage:

High-class child-marriage,
Middle-class child-marriage,
Lower-class child-marriage.

Widow-marriage,	Wife-stealing,
Polygamy,	Polyandry.

Spirit-scarers used in Hindu marriage:

Fire,	Yellow,	Oil,	Eating together,	Noise,
Rice,	Knots,	Horse,	Cocoanuts,	Red,
Cock,	Sugar-cane,	Dancing,	Metal,	Circles,
Dung,	Water,	Black,	Shells,	Fruit,
Marriage with trees,		Cloth,	Liquor,	Grass,
Hoisting,		Earthen-pots,	Miscellaneous objects.	

R. Womanhood.

S. Pregnancy.

Bombay Yajurvedi Brahmans,
Thana Vadvals,
Thana Parsis.

T. Funeral.

Descriptive funeral-rites:

Death-day rites,	Special funeral-rites,
After-death ceremonies,	Commemorative rites.

Meaning and origin:

Belief that man has several spirits.
Early and Brahmanic rites.
Devices to keep Spirit from his former haunts.

Spirit-scarers in Hindu funeral:

Fire,	Colors,	Cow,	Horse,
Urine,	Flowers,	Sweet basil and nim,	
Grain,	Metal,	Oil,	Circle,
Sacred grass,	Water,	Noise,	Leather,

Feasting and cleansing the mourners.—*O. T. Mason.*

PSYCHOLOGY.

Evolution and Idealism.—Evolution must be regarded as having completely abolished Berkeleyan idealism. If the external or objective universe is only subjective, the evolution of that universe must have been a reflection of that of mind; but as minds have been, and are, in various stages, at any given period of the history of evolution, there must have been many universes at one and the same time. Consider for a moment the metaphysics of the barn-yard. The various domestic fowls, and the mammalia, cat, dog, pig, ox, horse, etc., must each be the author

of a different objective environment, all differing from that of man. But the environment is believed by evolutionists to be a very important element in the development of mind. If, however, the environment is the product of mind, there has been no antecedent environment, as understood by evolutionists. These two absurdities must prevent any consistent biologist from being an idealist in the Berkeleyan sense. The services of evolution in explaining the so-called innate ideas have been shown by Spencer to be very great. Innate ideas are seen to be inherited ideas, or the function of inherited structure; but as evolution requires also acquired ideas, the field of controversy between the intuitional and experiential theories is narrowed to these. Evolution stands on the experiential ground; not but that there is some axiomatic truth which the developed human mind is able to grasp without more experience than that necessary to a statement of the proposition; but without evolution by experience, man would never have acquired the power necessary to do this. —*E. D. Cope.*

MICROSCOPY.[1]

O. Schultze's Method of preparing the Amphibian Egg.[2]— For hardening-fluids the following mixtures were found to give perfectly satisfactory preparations, when used in the manner described below:

1. *Chrom-osmio-acetic Acid.*

Chromic acid (1%)	25 parts.
Osmic " "	10 "
Water	60 "
Acetic acid (2%)	5 "

2. *Chrom-acetic Acid.*

Chromic acid (1%)	25 parts.
Acetic " (2 ")	5 "
Water	70 "

The eggs are left in one of these fluids twenty-four hours, then washed in distilled water, which should be often changed. The egg-envelopes are next removed by the aid of needles, and the eggs are then ready for surface-study.

For the purpose of sectioning the eggs are transferred from the water used in washing to 50% alcohol, then to 70%, 85%, and 95%, leaving them twenty-four hours in each grade. The last grade should be changed several times. The eggs are then clarified in turpentine one to two hours, and then placed in paraffine that melts at 50° C. for one-half to one hour.

[1] Edited by C. O. WHITMAN, Ph.D., Milwaukee, Wisconsin.
[2] O. Schultze, Zeitschr. f. wiss. Zool., xlv., H. 2, p. 185, April, 1887.

Schultze states that the success of the method depends on following precisely the directions given as to time. If the eggs remain longer, either in alcohol, turpentine, or paraffine, the results may be entirely unsatisfactory. If the conditions are strictly followed the eggs have the consistency of the paraffine, and cut excellently without crumbling in sections $\frac{1}{200}$ mm. thick.

For staining borax-carmine was used, directly after washing, twenty-four hours. The eggs were next placed in acid alcohol of seventy per cent. (five drops of the pure acid to 100 ccm. of the alcohol) to remove a part of the color.

The first hardening fluid does not penetrate well, and is not well adapted for fixing the central parts of the egg.

Baskets for the Suspension of Objects in Paraffine.—Mr. H. Garman recommends the use of wire baskets for suspending objects in paraffine. Such a basket is easily made by coiling

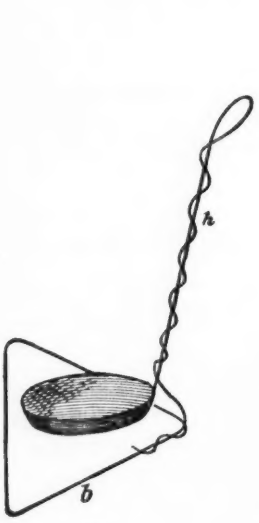


FIG. 1.

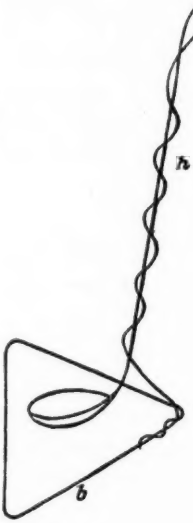


FIG. 2.

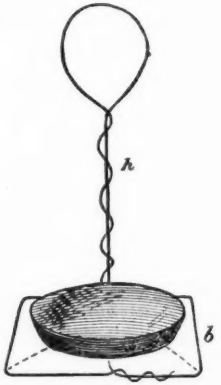


FIG. 3.

annealed wire as shown in Fig. 1, beginning at the centre of the bottom, and working outwards to the margin, then making the handle (*h*), and finishing with a triangular base (*b*). In use it is placed in the melted paraffine, the triangular base supporting and keeping it from the bottom of the paraffine basin; and it can be removed by means of the projecting handle, which is made of such length that it does not interfere with the glass

cover of the basin. For very small objects a hammered-wire spoon, like that used by Dr. Mark, is mounted in the same way as the basket (Fig. 2). This method of suspending objects in paraffine has resulted from attempts to avoid long handles, or other belongings of the baskets, that prevent the close fitting of the plates of glass used to cover the paraffine dishes.

A New Section-Smoother.[1]—Dr. P. F. Mall recommends a section-smoother constructed on the following principle. It consists of a rubber rod, about 1¼ cm. in diameter, which rotates *loosely* on a solid axis. The rod is so placed that it hangs a little below and in front of the edge of the knife (Fig. 1). When the

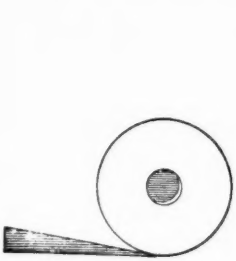


FIG. 1.

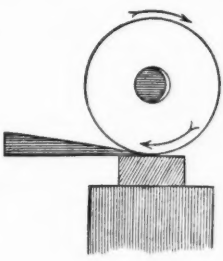


FIG. 2.

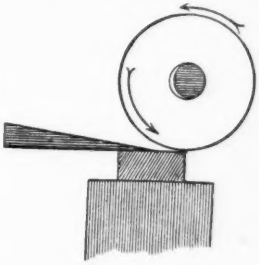


FIG. 3.

knife passes over the object the rod is raised to an extent equal to the thickness of the section, and is thrown above and a little behind the edge of the knife (Fig. 2), so that the section is prevented from rolling as it slides upon the knife. When the knife is shoved back preparatory to making the next section the rod rolls over the preparation, and, in consequence of the play of its axis, is kept free from edge of the knife. The section does not stick to the rod, as is the case in Jung's section-smoother.

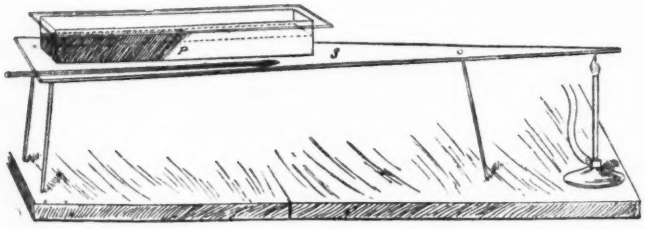
A New Paraffine Imbedding Apparatus.—Those who have had much experience in imbedding in paraffine are aware of the difficulties and risks which attend the imbedding of delicate objects on account of the danger of overheating the imbedding mass. The trouble with thermostats, or heat-regulators, is that they get out of order and give trouble, aside from the difficulty which arises from the variations in the pressure of the gas in the pipes which supply the burners, and which is entirely beyond the control of most forms of the thermostat.

To avoid this, Dr. C. S. Dolley, of the Biological Department of the University of Pennsylvania, began a series of experiments

[1] Archiv f. Anat. u. Physiol. Anat. Abth., 1887, H. 1, p. 3.

with copper bars, which were heated at one end by means of a Bunsen burner, so that the heat conveyed by conduction to the remote end of the bars gradually diminished in intensity because of its being constantly radiated into the surrounding air, according to well-known laws stated in the text-books on physics. It was found that, with the room at an approximately constant temperature, there was a point along the bar, at a certain constant distance from its heated end, where the temperature of 55° C. could be maintained, and where, if there was placed a copper cup filled with hard paraffine, the latter could be kept just at the point of fusion for a long time without endangering the objects to be imbedded. These results showed that it was possible to utilize an apparatus of this type for imbedding purposes.

This led the writer of this to begin a set of experiments with a very simple modification of the foregoing type of apparatus,



with the object of getting rid of the usual water-bath entirely in the process of imbedding, and to also use the paraffine itself as a means to indicate how far away from the source of heat it would be safe to allow an object to remain while it was being saturated.

This object was effected in the following manner: A triangular sheet of copper, slightly less than one-sixteenth of an inch thick, eighteen inches long, and ten inches wide at one end and running to a sharp point at the other, as shown at *s* in the accompanying figure, is supported horizontally upon two legs at the wide end, and at some distance from the pointed end by another leg, these three legs constituting a firm tripod base for the whole device. Under the pointed end of the triangular plate of copper is placed a small Bunsen gas-burner, with an aperture of about one-eighth of an inch, and connected with the gas-supply of the building by means of a rubber tube. If the flame is allowed to burn steadily at about half its full force, and permitted to play upon the copper plate at a distance of about one inch from its extreme point, as shown in the figure, the whole plate will soon be heated, but the temperature will be found to gradually diminish towards the wide end. At a distance of about twelve to thirteen inches from the

point where the flame acts upon the copper plate the temperature will remain steadily at about 56° C. (133° F.), with the temperature of the room at 22° C., or 71° F. As long as the temperature of the room remains nearly the same the temperature of the plate at any given distance from the burner will also remain at the same point. This constancy is due to the fact that the heat which is conducted through the copper plate with constant rapidity from its source—the burner—is radiated into the surrounding air at an equally constant rate, and, as one passes towards the wide end of the plate from the burner, trials with the thermometer show that there may be found an infinite number of points in succession at which the temperature is very nearly constant.

In order to use the paraffine itself as an indicator of the proper temperature, and in that way dispense with a thermometer altogether, if desirable, it was necessary to use a new type of cup in which to melt the paraffine. The paraffine-cup or trough (P) shown in the figure is made of copper, tin-lined, and is six inches long, one and one-half inches wide, and one and one-fourth deep. In practice the cup is half filled with paraffine and placed lengthwise on the copper plate, with its narrowest side towards the flame and about nine inches from it, as shown in the cut. The paraffine-cup may be covered with a strip of glass to exclude dust. If the burner plays upon the plate as directed, and the trough is in the proper position, in about an hour it will be found that the paraffine in the trough has been melted at the end nearest the burner, but has remained congealed at the other. Moreover, it will be found that the point where the melted comes in contact with the nearly frozen paraffine is very constant, and it is just at this point where it is safe to place objects which are to be imbedded. The paraffine which remains congealed in the trough is represented in the cut by the shading at the remote end of the trough, the clear space below the dotted lines nearest the flame indicating the portion which remains molten.

It is clear, from what has preceded, that a shorter cup or trough filled with soft paraffine melting at 36° C. may be placed still farther away from the burner, alongside of the vessel containing hard paraffine fusing at 56° C., while mixtures of turpentine and paraffine or chloroform and paraffine would remain molten at a still greater distance from the flame.

The applications and possibilities of this new device will be readily appreciated by histologists and embryologists, since it can be quickly seen if objects are in danger from overheating by simply noting whether the point where the paraffine remains molten in the trough has advanced farther from the flame. This can be easily observed through the transparent cover of the trough.

For large laboratories, where a number of students are engaged in imbedding, a simple modification of this device suggests itself. For such a purpose a horizontal disk of sheet-copper, of the same thickness, but three feet in diameter, would afford room for a large number of paraffine imbedding-troughs, which could be arranged in a circle around and some distance from the centre, at which point a larger burner would be applied underneath. The temperature in such a device would diminish from the centre towards the periphery of the disk. The troughs would be placed upon different radii upon the surface of the disk, just as two or three troughs may be placed upon different radii of the triangular plate, which is practically the sector of a disk, as described above.

For imbedding delicate objects, small cups made of tin-foil, pressed into shape in circular, tapering moulds, may be satisfactorily employed with this apparatus, in the same way as the troughs.

The device described above can be made by any coppersmith for about two dollars.—*John A. Ryder.*

SCIENTIFIC NEWS.

—The Harvard Natural History Society this year celebrates the fiftieth anniversary of its foundation by a course of popular lectures on the Fauna of Massachusetts. The series embraces Birds, by Wm. Brewster; Reptiles, by Samuel Garman; Fishes, by Mr. Collins; Butterflies, by S. H. Scudder; Beetles, by Geo. Dimmock; Crustacea, by J. S. Kingsley; Spiders, by J. H. Emerton; Worms, by C. S. Minot; Cœlenterates, by S. F. Clarke; Sponges, by A. Hyatt; and others which have not yet been fully arranged for. The Harvard Natural History Society is second in age of college societies, and has embraced many of the prominent naturalists among its members. In times past it had collections and a library, but the specimens were long ago turned over to the Museum of Comparative Zoology, while the library of late years has grown but little, the University furnishing abundant facilities in this direction.

—Bernard Persh, late hospital steward at the Frankford Arsenal, near Philadelphia, died recently of typhoid pneumonia, at the age of thirty-seven. He was an enthusiastic microscopist, and had lately been conducting considerable investigations in bacteriology, and was very successful in photographing these organisms. Personally, he was a pleasant companion.

—Toeplitz and Deuticke, of Leipzig, announce a new journal, the *Centralblatt für Physiologie.* It is edited by Dr. Sigmund Exner, of Vienna, and Dr. Johannes Gad, of Berlin, and is issued under the auspices of the Physiological Society of Berlin. The first number appeared April 2, and the subsequent numbers will follow every two weeks. The subscription price is sixteen marks a year.

—Dr. W. Spengel, who has recently occupied the position of Director in the Bremen Museum, goes to the University of Giessen as Professor of Zoology.

—Professor C. Klein, of Göttingen, goes to the University of Berlin as successor to the late Professor Websky, whose death was announced in our March number. The chair of Mineralogy thus left vacant at Göttingen is filled by Dr. T. H. Liebsch, formerly of Königsberg.

—Professor A. Ludwig, of Giessen, has been called to Bonn to fill the chair left vacant by the retirement of the venerable Professor Dr. Franz Leydig.

—The well-known house of R. Friedländer und Sohn (Berlin) have begun the publication of another bibliographical periodical, *Bericht über die Verlagsthätigkeit von R. Friedländer und Sohn,* which is intended as a quarterly list of the publications of this house in the line of science.

—Dr. R. W. Schufeldt calls attention in the *Auk* for April to the valuable assistance that can be derived from the photographic camera in field ornithology.

—Dr. Pelletan's *Journal de Micrographie* begins this year the publication of a series of portraits of French scientific worthies. The faces of J. Béclard and Mathias Duval have so far appeared, but they hardly answer the announcement of portraits "magnifiquement gravés ou photogravés . . . formeront autant d'œuvres d'art." They are rather poorer than the series of "Leaders of Science" published by the English *Science Monthly.*

—At a recent meeting of the Marine Biological Laboratory (which, as noted in the April number of the NATURALIST, is to be the successor of the Annisquam Laboratory) it was voted inexpedient to attempt to open the station this year. It was also voted to grant Mr. Van Vleck the use of the apparatus, etc., now at Annisquam for the present summer.

—John T. Ogden, for many years a well-known dealer in microscopical goods in Boston, died in that city May 3, 1887. He was born in Woodbury, N. J., June, 1811, and in early life was a civil engineer.

—The various scientific and educational institutions in and near New York City have appointed a local committee of arrangements for the coming meeting of the American Association for the Advancement of Science, with the following officers: President, Dr. F. A. P. Barnard, President of Columbia College; Vice-Presidents, Chauncey M. Depew, Mayor Abraham J. Hewett, Morris K. Jessup, Dr. Henry L. McCracken, George William Curtis; Local Secretary, Professor Henry Leroy Fairchild. Miss Winifred Egerton is the president of the ladies' section of the local committee.

—Recent deaths: Dr. Franz Herbich, a geologist and custodian of the Klausenberg Museum, died January 15; J. J. Kickx, Professor of Botany at Ghent, died March 27.

—Dr. Albert Kellogg, the well-known botanist of California, died in Alameda, in that State, on the 31st of March, at the age of seventy-four. He was born in New Hartford, Conn., and went to California in the early years of the great migration to the Pacific coast. He soon abandoned his professional work and devoted himself to the investigation of the botany of California, with which he has been identified for over thirty years. He was one of the founders of the California Academy of Sciences, and in the Proceedings and Bulletins of the Academy the results of his researches have appeared from time to time. He visited Alaska in 1867 as surgeon and botanist of the special expedition of that year, Prof. George Davidson being the scientific director. Dr. Kellogg's name fills a prominent place in all of the leading works relating to West North American Botany. He was a man of singular genuineness and simplicity of character, as guileless as a child, and abounding in kindly spirit and goodwill towards all.—*R. E. C. S.*

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

Boston Society of Natural History.—April 20, 1887.—Dr. J. Amory Jeffries read a note in which he took exceptions to certain statements made by Dr. E. G. Gardiner in his paper (*Archiv für microscopische Anatomie*, 1884) relative to the development of the epitrichium in birds. Mr. Edwin O. Jordan, in a paper entitled "'Vitality' of Minerals, Plants, and Animals," called attention to the recent address of President Judd of the Geological Society as reported in *Nature*, and pointed out the speciousness of the arguments advanced to show that the lines drawn between the organic and the inorganic departments of

nature are false, and showed the absurdity of the claim that plants have more "vitality" than animals, and minerals more "vitality" than plants.

May 4, 1887.—Annual meeting.—The annual reports of the secretary, treasurer, and curator, were read and approved, after which came the election of officers for the ensuing year, with the following result: President, F. W. Putnam; Vice-Presidents, John Cummings, Geo. L. Goodale; Curator, Alpheus Hyatt; Honorary Secretary, S. L. Abbot; Secretary and Librarian, Edward Burgess; Treasurer, Charles W. Scudder, and a board of twenty Councillors. The retiring president, Mr. S. H. Scudder, then gave an interesting paper of his investigations of the distribution of the cabbage butterfly (*Pieris rapæ*) over America. Awhile ago he sent out several hundred circulars to selected persons, and points requesting all available data regarding this pest, and the paper read was the outcome. Mr. Scudder found nothing earlier than the historic introduction near Quebec, but was of the opinion that there was some evidence of its later introduction at other points. A feature in the dissemination of the species was its more rapid advance along the line of railways.

Natural Science Association of Staten Island.—New Brighton, April 9, 1887.—Steps were taken to form a local committee to represent the association in all matters that may arise from the meeting of the American Association in New York City next August. Dr. N. L. Britton made remarks upon the fungi collected by the members of the association during the past two years, most of which had been named by Mr. J. B. Ellis. Ten printed lists of the fossils found in the drift of Staten Island, by L. P. Gratacap, were distributed.

Indiana Academy of Science.—This society held its second field-meeting near Waveland, Montgomery County, Ind., May 19 and 20. Over thirty members were present.

Thursday, 19th, the day was spent exploring the wild and rugged region along Sugar Creek, known as "Shades of Death." In the evening Prof. T. C. Mendenhall, of Rose Polytechnic Institute, Terre Haute, delivered an address on "Weather Prediction."

Friday was devoted to an exploration of the valley of Clifty Creek and Pine Hills. The evening session was occupied in discussing the natural history of the region visited, and some of the results are of value to science.

The next meeting will be held, the last week in December, at Indianapolis.

Biological Society of Washington.—April 16, 1887.—The following communications were read: W. H. Dall, "Notes on a

recent Exploring Trip in Florida;" H. G. Beyer, U.S.N., "On the Action of Caffeine upon the Kidneys;" C. H. Merriam, "Ravages of the Bobolink in the Rice-Fields of the South."

April 30.—The following communications were read: J. H. Kidder (1), "Specimen of Concoction found in a Cod-Fish;" (2), "Grass Balls from Pyramid Lake;" G. Brown Goode, "Notes on the Color of Fishes;" F. A. Lucas, "On the Os prominens in Birds;" W. T. Hornaday, "Civilization as an Exterminator of Savage Races;" William H. Dall, "A Genus of Mollusks new to North America."

May 14.—The following communications were read: Marshall McDonald, "The Causes of Certain Failures in the Culture of the Salmonidæ;" C. V. Riley, "Notes on Southern California;" P. L. Jouy, "A Bird new to Japan,—*Pitta oreas* Swinhoe, from the Island of Tsushima;" F. H. Knowlton, "The Recent Shower of Pollen in Washington,—the so-called 'Sulphur-Shower;'" W. B. Barrows, Engineer G. W. Baird, U.S.N., and others, "Does the Flying-Fish Fly?"